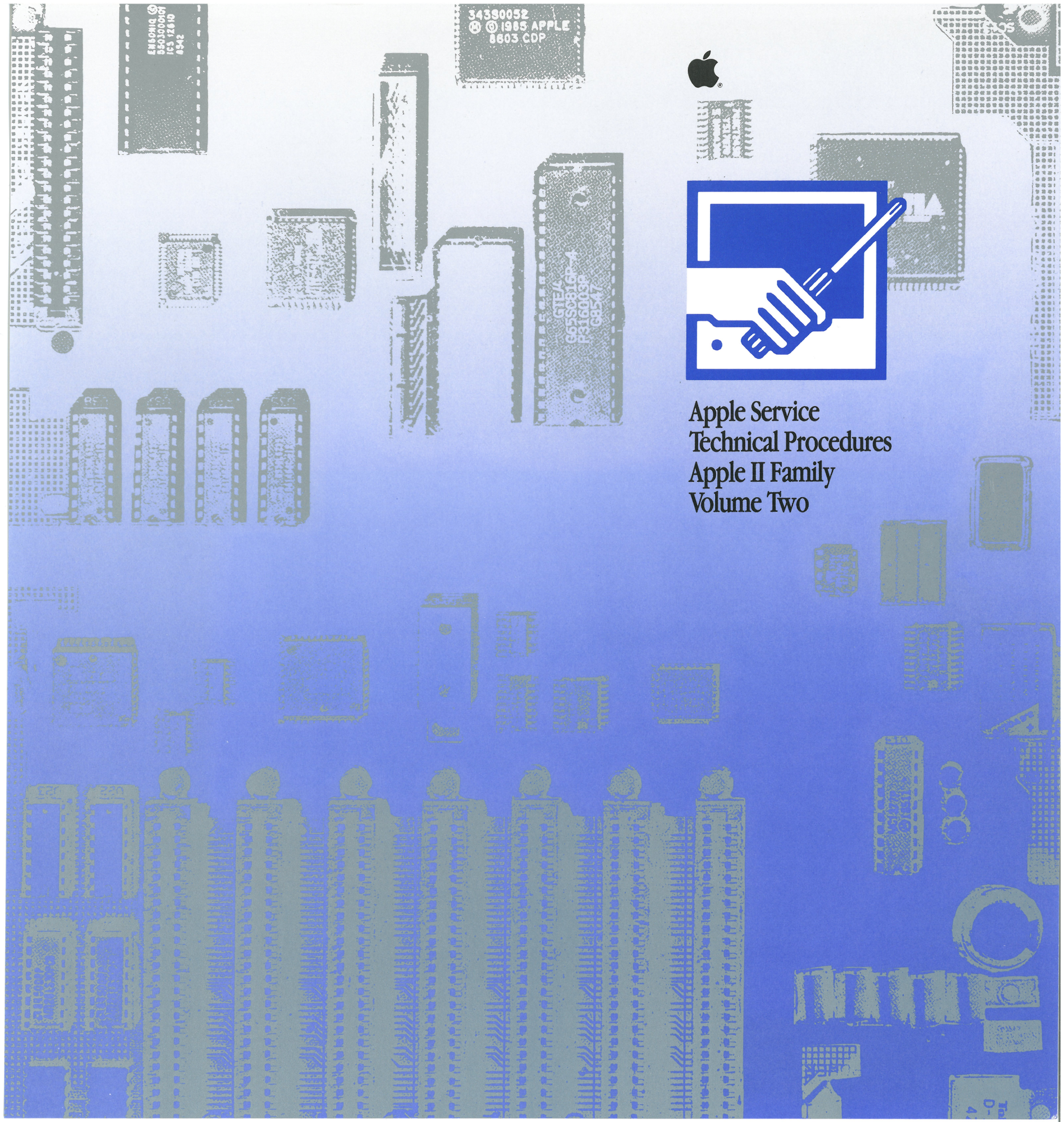

Apple Service Technical Procedures Apple II Family Volume Two

Apple Service Technical Procedures Apple II Family

Volume Two

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Apple Technical Procedures

Apple II Family
Volume Two

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Multi-Product Diagnostics

Technical Procedures

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Section 1 – Apple Peripherals Diskette

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❑ INTRODUCTION

The Apple II Peripherals Diskette contains a series of functional tests for the Apple II monitors and printers and a diagnostic test for the Apple II Memory Expansion Card.

The tests may be run on any of the following computers: Apple II, II Plus, IIe, and IIc. You may also run the tests on the Apple III if you boot the Apple II Emulation program first.

Exceptions

1. The Memory Expansion Card test cannot be run on the III.

2. The Dot Matrix Printer test cannot be run on the IIc.

3. The Silentype test cannot be run on the IIc or III.

This section contains instructions for running the monitor and printer tests of the Peripherals Diskette. Instructions for the use of the Memory Expansion Card test are found in the **Memory Expansion Card Section** of the *Apple IIe Technical Procedures*.

Use of the Peripherals Diskette is very simple. For the functional tests, the user observes the results of the test (the output on the screen or printer paper) and decides for himself if the device is functioning properly. For specific information on an acceptable level of functioning for the device (and its repair or adjustment) see the appropriate Technical Procedures.

Materials Required

Apple II Peripherals Diskette
Apple II, II Plus, IIe, or IIc computer (or Apple III with Apple II Emulation Diskette) Monitor
Printer to be tested (optional):
- ImageWriter
- 15-inch ImageWriter
- ImageWriter II
- Daisy Wheel Printer (with Courier 10 print wheel)
- Dot Matrix Printer
- Scribe
- Silentype

❑ GENERAL INFORMATION

Materials Required

Apple II Peripherals Diskette
Apple II, II Plus, IIe, or IIc computer (or Apple III with Apple II Emulation Diskette) Monitor
Printer to be tested (optional):
- ImageWriter
- 15-inch ImageWriter
- ImageWriter II
- Daisy Wheel Printer (with Courier 10 print wheel)
- Dot Matrix Printer
- Scribe
- Silentype

Main Menu

Set up the selected computer, monitor, and printer (optional). Insert the Apple II Peripherals Diskette into the computer's disk drive and turn on the computer and the peripheral(s). The main menu will appear:

1. **Monitors**
2. **Printers**
3. **Apple II Memory Expansion Card**

Type the number of the test classification you want. If you press <ESC> you will exit the program.

❑ MONITOR TESTS

When you select the monitor tests from the main menu, six test pattern options (plus "Test All") will appear. Type the number of the test pattern you wish to view. If you are a first-time user of the diskette, it is handy to use "Test All" first so that you can view all the test pattern options. Each pattern will remain on the screen until you do one of the following:

Press the spacebar	(for "Accept," or "Pass")
Type X	(for "Reject," or "Fail")
Press <ESC>	(to return to the monitor menu)

Note: On individual tests, you are returned to the monitor menu after you indicate a "Pass" or "Fail." (If you selected "Test All," the next test pattern will be displayed automatically.)

The results of the testing are indicated on the monitor menu.

The judging of test results is purely subjective.

The Pass/Fail selection is provided so that you may keep track of the results of each test as you go along.

Monitor Test Options

0. Test All – Displays all six monitor tests in sequence below.

1. Dot Pattern – Shows a 20x28 column dot pattern crossed by two diagonal lines (corner to corner).

This test can be used to indicate whether yoke and ring alignment are correct.

Monitor Test Options

2. *Grid Pattern* – Shows a grid of 11 vertical lines intersected by 11 horizontal lines.

   This test can be used to indicate correct yoke and ring alignment.

3. *40-Column Display* – Shows text display of 23 lines of 40 characters each.

   This test can be used to test character generation and vertical and horizontal size.

4. *80-Column Display* – Shows text display of 23 lines of 80 characters each.

   This test can also be used to test character generation and vertical and horizontal size. **This test will run ONLY if there is an 80-column card installed, and will NOT run on the Apple II Plus.**

5. *Color Bars* – Shows vertical color bars with the name of each color below.

   This test can be used to adjust the color of color monitors.

6. *Full White Screen* – Shows a full white screen.

   This test can be used to check for white balance (a color monitor adjustment).

❑ PRINTER TESTS

Before you begin, make sure the printer you wish to test is properly configured for the computer you are using (that is, make sure the dip switch settings are the same for both the interface card and the printer). **If you are using a IIe or II Plus, note the slot in which the interface card is installed.**

Note: If you are using an Apple III, you must first boot the Apple II Emulation program, press <ESCAPE> to go into "Options," and set the baud rate to match the printer dip switch settings. Then insert the Peripherals Diskette and press <RETURN> to boot. (If you are using the Dot Matrix Printer with the Apple III, you must first install a UPIC card in slot 2 of the Apple III, with the switch on the card set to "AUTO." Then, when you boot the Emulation program, go into Options and set "Line Width" to 80. Then insert the Peripherals Diskette and press <RETURN> to boot.)

When you select the printer tests from the main menu, seven Apple II compatible printers are listed for you to choose from:

1. ImageWriter
2. 15-inch ImageWriter
3. ImageWriter II
4. Dot Matrix Printer
5. Daisy Wheel Printer
6. Scribe
7. Silentype

Enter the number of the printer you wish to test:

Apple IIc

- You will be prompted to enter the slot number. Enter slot "1" and be sure the printer is set at 9600 baud.

Apple III

- With all serial printers, slot 5 (RS-232 port) will automatically be assigned and the selected printer menu will appear. As noted above, when you are using the Apple III to test the Dot Matrix Printer (parallel), the UPIC card must be installed in slot 2 and the switch on the card set to "AUTO." Slot 2 will then automatically be assigned. You need only press <RETURN>.

Apple II Plus or IIe

- You will be prompted to enter the slot number where the interface is installed. If you select the wrong slot number (without pressing <RETURN>), press <ESC> and start over. If you type in the wrong slot number and press <RETURN>, you must reboot by turning the computer off and on (or wait while the program finishes the test sequence).

When the printer's menu screen appears, it will list the tests available for that printer. (The table at the end of this section shows the tests available for each printer.)

Enter the number of the test you want. The name of the test selected will head the printout, followed by the pattern of characters the test displays.

Note: When testing a printer with an Apple III under Emulation mode, the printer carriage may bounce to the extreme right before beginning the test printout. Ignore this reaction.)

The character set test and custom characters test run continuously until you do one of the following:

Press the spacebar (for "Accept," or "Pass")

Type X (for "Reject," or "Fail")

Press <ESC> (to return to the printer menu)

The remaining tests print a number of lines (usually five) as a sample, then give you the additional option below:

Press <RETURN> (to repeat test)

Note: After you indicate a "Pass" or "Fail" the printer menu returns automatically.

The results (Pass, Fail) you give the printer for each test are indicated on the printer menu.

The Functional Test prints each available test in sequence (about five lines of each). The test can be aborted at any time after starting by pressing <ESC>. The test sequence will stop and you will be returned to the selected printer's menu. This feature allows you to stop the test sequence in case of paper jams, etc.

Printer Test Options

- *Functional Test* – Performs a prescribed number of iterations (usually five) of each test available for the printer being tested.

- *Character Set* – Continuously prints the full set of characters, with underlining.

  This test is used to check character generation.

- *Alternate Sets* – Prints one each of all alternate character sets available.

  This test checks the printer's interpretation of the logic board commands for alternate character sets.

- *Custom Characters* – Continuously prints any customer-designed characters.

  This test checks the circuitry used for downloading a custom character and the ability of the printer to print the character when called.

- *Graphic Images* – Prints 5 horizontal lines - very narrow to very wide. (On the DWP, this test prints text and overcast X's in graphic mode. On the Silentype, this test produces a picture.)

  This test checks the ability of the printer to interpret graphic commands sent to it.

- *Margin/Tabs* – Prints lines and tabs with measurements given for verification, as in the example at left (Figure 1), which shows the test printout from ImageWriter II.

  Before the test begins, you are given a chance to align paper in the printer. Press <RETURN> when you are ready to begin.

If paper is aligned in the printer correctly, the distance from the top of the page to the interspace between the first two printed lines (Figure 1, #1) and the distance between tab lines (Figure 1, #2) should be as indicated on the printout, give or take the acceptable variance. The measurements given will vary from printer to printer.

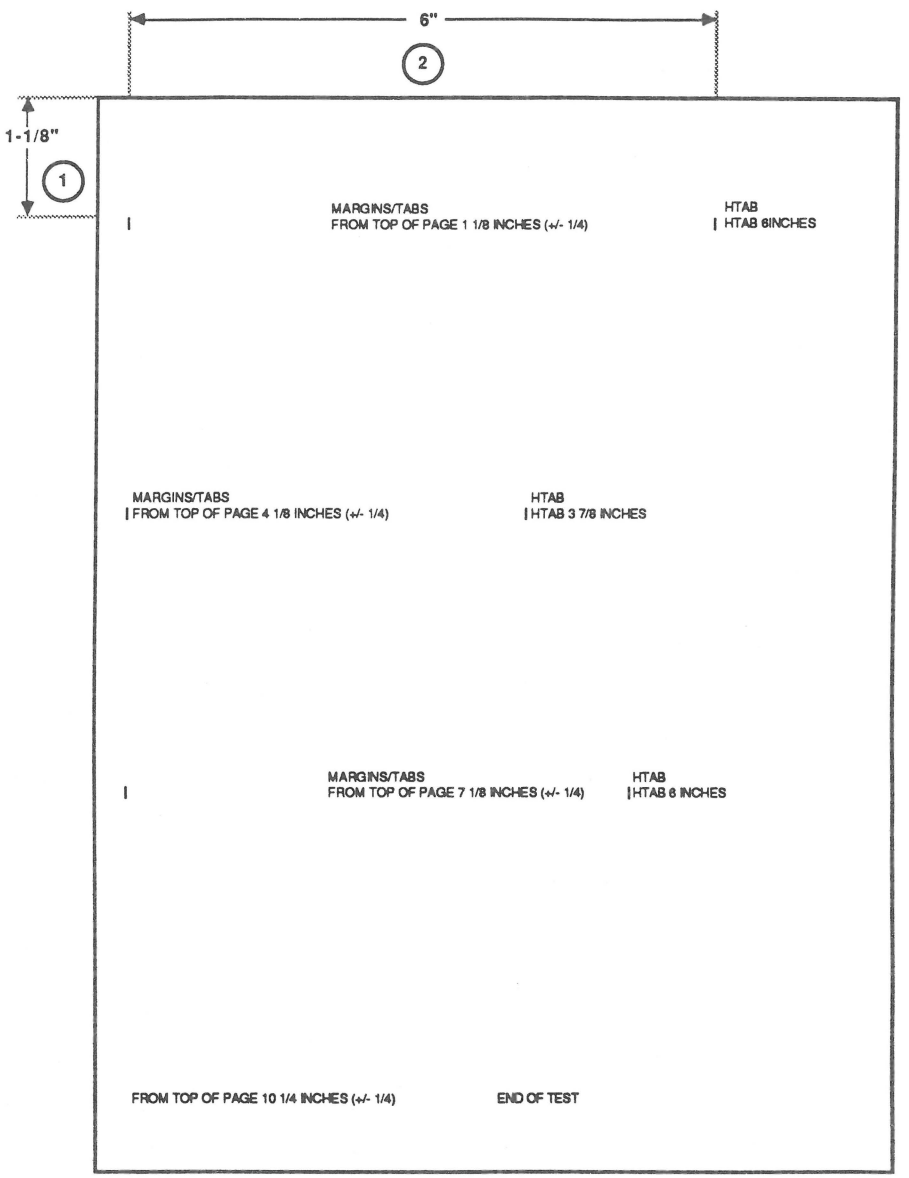

FIGURE 1

Printer Test Options

- *Registration* – Prints rows of underlined bar lines (I I I I I I I I I I I I I I I I I I). On the Silentype, the test prints rows of H's (HHHHHHHHHHHHHHHHH).

  This test allows you to check the vertical and horizontal alignment (firing hammer adjustment). Run this test several times before making any repairs on the printer.

- *Color Test* – (ImageWriter II and Scribe only)

  ImageWriter II - Prints five lines each of the full character set in the following colors: yellow, purple, red, green, blue, orange, and black.

  Scribe - Prints five lines each of the full character set in three colors: yellow, blue, and red.

  This test allows you to test the printer's interpretation of the color commands from the computer's logic board and to test the mechanical operation of the color ribbon and the adjustment of the color cam.

- *Print Intensity* – (Silentype only)

  Prints one line of each intensity setting from 0 to 7.

  This test checks the printer's mechanical components and the interpretation of the intensity settings.

- *Mouse Text* – (ImageWriter II only)

  Prints five lines of mouse text characters.

  This test checks printer's ability to interpret and print mouse text characters when called.

❑ PRINTER TEST TABLE

Name of Test	IW	IW-15"	IW-II	DMP	DWP	Scribe	Silent
Functional Test	x	x1	x	x	x2	x	x
Character Set	x	x	x	x	x	x	x
Alternate Sets	x	x	x	x	x	x	
Custom Characters	x	x	x	x			
Graphic Images	x	x	x	x	x3	x	x4
Margin/Tabs	x	x	x	x	x	x	
Registration	x	x	x	x	x	x	x
Color Test			x			x5	
Print Intensity							x
Mouse Text			x				

Notes

1. The tests of the 15-inch ImageWriter print to 15 inches.
2. Use a Courier 10-pitch daisywheel for the DWP tests.
3. On the Daisy Wheel Printer, the Graphic Image is composed of text and a line of overcast X's done in graphics mode.
4. On the Silentype, the Graphic Image is a picture.
5. On the Scribe, you will be prompted to insert the color ribbon just before the color test, and instructed to remove it and replace the black ribbon after the color test is completed.

Apple Technical Procedures

Multi-Product Diagnostics

Section 2 – 5.25-Inch Floppy Drive Test

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❑ INTRODUCTION

The *5.25 Floppy Drive Test Assembly, Version 1.0,* hereafter called the diagnostic, contains three disks: one copy of the program disk (*Apple 5.25 Floppy Drive Test)* and two copies of the reference disk (*Apple 5.25 Floppy Drive Test Reference Diskette*).

The reference disk contains no software and, therefore, is **not a bootable disk.** In addition, because of specially coded test features, the reference disk is **not copyable.** You should, therefore, always have two copies of the reference disk. (When a disk needs replacing, you can exchange it through the Media Exchange Program.)

The diagnostic checks all the major functions of the following disk mechanical assemblies:

- Apple 5.25-Inch Disk Drive (module 72128)
- Apple Disk II (module 92012)
- UniDisk/DuoDisk (module 72128)
- Apple IIc internal and external (module 0264)
- Apple III internal (module 92014)
- Apple III external (module 92015)

Note: The diagnostic can test the Apple III drive mechanical assembly if you first remove the Apple III disk analog board (module 92002) and replace it with a known-good Apple II disk analog board (module 92001). See "Apple III or III Plus" for complete instructions.

The diagnostic runs on any Apple II family CPU that has 128K memory and 80-column display capability.

IMPORTANT: *Before using the disks, remove them from the plastic shipping package and leave them (in their protective envelope) on your workbench for 24 hours. This allows the disks to adjust to the temperature and humidity of the room. If this precaution is not taken, the diagnostic can give incorrect and unpredictable results.*

❑ THINGS TO REMEMBER

Operating the Diagnostic

Keep the following points in mind when you are running the diagnostics:

- Boot from the program disk on a known-good drive (drive 1).
- Use a formatted, blank disk in the drive under test (drive 2) when running the first four tests (Write Protect, Read and Seek, Write and Verify, and Disk Speed).
- Press <Esc> to
  - Abort the test in progress and return to the Main menu.
  - Discontinue looping (when **Loop Tests Until ESC is Pressed** [Options menu] is selected).
  - Return to the Main menu from a submenu.
- When running the diagnostic on the Apple IIGS, **do not** attempt to enter the Control Panel while a test is running. Doing so may cause unreliable results.
- When a drive fails a test, the diagnostic automatically stops. If you want to run the other tests on the drive, you must do one of the following:
  - Choose the tests on the Select Specific Test menu, and then run the tests by selecting **Execute Selected Tests** from the Main menu.
  - Select **Continue on Error** from the Options menu.
- If a drive fails during a diagnostic test, try
  - Removing and reinserting the disk
  - Using another reference disk (for Clamping and Radial Alignment test and Hysteresis test only)

  If the drive fails again, return the entire 5.25-inch drive mechanical assembly to Apple for replacement. (See "Special Packaging and Procedures" in the Product Notices section of the *Service Programs* manual for proper packaging procedures.)

Handling the Disks

Keep the following points in mind when you are handling the disks:

- Damaged disks may cause incorrect test results and may even fail good drives. Therefore, we recommend that you
  - Inspect the inner disk ring for physical damage such as indentations, tears, or warping.
  - Use a known-good drive to verify that the reference disk and the blank, formatted disk are operative.
- Insert the disk into the drive carefully and close the drive door gently.
- Return to the Main menu before removing disks except when the diagnostic prompts you to
  - Open and close the disk drive during the Write Protect test.
  - Insert a specific disk.
- Boot the system with the program disk (*Apple 5.25 Floppy Drive Test*) on a known-good drive (drive 1). Then remove the program disk.
- Apple highly recommends that you use the reference disk for the Clamping and Radial Alignment test and the Hysteresis test **only**. Use a blank, formatted, known-good disk for all other tests.

❑ THE TESTS – WHAT THEY DO

Write Protect

Checks the function of the disk drive's write-protect switch. In other words, the test verifies that the drive won't write on write-protected disks, and will write on unprotected ones.

Read and Seek

Tests the disk drive read circuitry. Also, the test "exercises" the drive by performing the random head movement the drive would be subjected to in actual use.

Write and Verify

Performs a write and a read of the disk and compares the two values.

Disk Speed

Checks the speed at which the disk is spinning. If a drive does not boot disks, or gives many I/O error messages, or produces disks that other drives cannot read, the drive may be spinning too fast or too slowly.

Clamping and Radial Alignment

Verifies that the disk is seated properly on the spindle when it is installed in the drive with the door closed. This test also checks the radial alignment to make sure it is adjusted properly and verifies that the head moves to the center of each track. If a drive is having trouble booting, or having compatibility problems with other drives (one drive has trouble reading what the other drive writes, for example), the drive may be out of alignment.

Hysteresis

Moves the read/write head to track 0 (to recalibrate), then to track 16, to track 34, and finally back to track 16. It then verifies that the read/write head is truly at track 16 and has not "drifted" during the head movement.

❑ MATERIALS REQUIRED

- The program disk—*Apple 5.25 Floppy Drive Test, Version 1.0* (part number 077-0324)
- The reference disk—*Apple 5.25 Floppy Drive Test Reference Diskette Version 1* (part number 077-0325; required for the Clamping and Radial Alignment test and Hysteresis test)
- A formatted, blank, known-good floppy disk (for the Write Protect, Read and Seek, Write and Verify, and Disk Speed tests)

WARNING: *Because the software is constantly writing and reading the disk during the Disk Speed test, disks removed during this test will, quite likely, be partially erased. Partially erased disks will either fail to boot the next time they are used or will consistently fail the Read and Seek test (and possibly other tests). For this reason, we strongly recommend that you use a formatted, known-good, blank disk rather than the reference disk when running the Disk Speed test.*

- Known-good Apple II family CPU that has 128K memory (minimum) and 80-column display capabilities
- Known-good Apple II disk analog board (module 92001—if testing an Apple III disk mechanical assembly)
- Known-good disk controller card (module 92011 or 92131, as appropriate for the drive under test—if testing an Apple IIe)
- Disk drive to be tested
- Known-good disk drive
- ProDOS 8, version 1.7 as the system software

❑ SETUP

Read this section only if you are running the diagnostic on an Apple III or III Plus drive mechanical assembly. For all other drives, go directly to "Running the Diagnostics."

To prepare an Apple III or III Plus for the diagnostic tests,

1. Remove the Apple III or III Plus analog board (see Figure 1) from the disk drive.

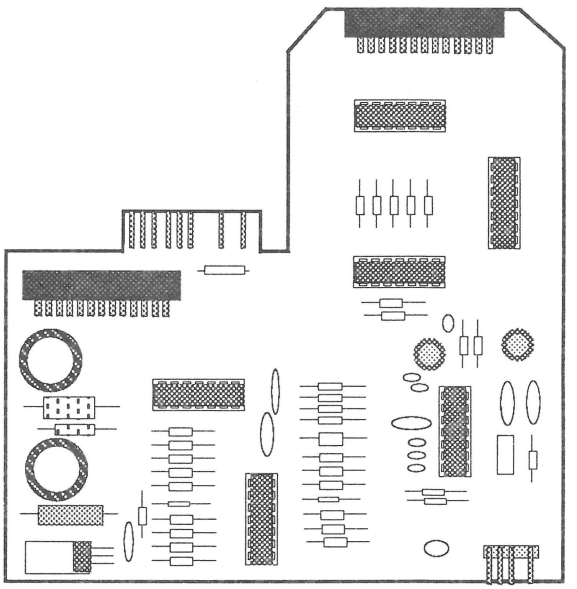

FIGURE 1

2. Replace the Apple III analog board with a known-good Apple II analog board (see Figure 2).

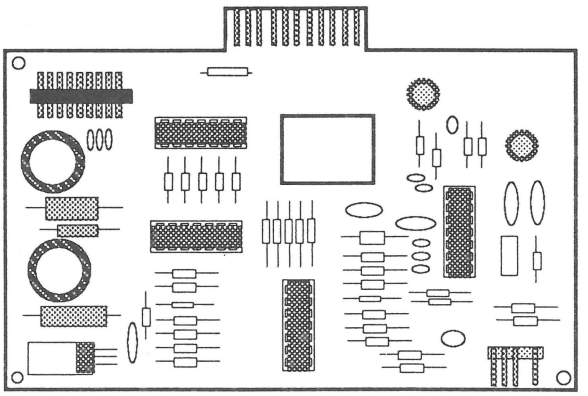

FIGURE 2

3. Set up the computer, disk drive(s), and monitor.

❑ RUNNING THE DIAGNOSTICS

Introduction

The diagnostic has been written with all the software on the program disk (*5.25 Floppy Drive Test*) and the additional reference signals necessary for the last two tests (Clamping and Radial Alignment and Hysteresis) on the reference disk (*Apple 5.25 Floppy Drive Test Reference Diskette*).

Note: The reference disk is not a bootable disk; you must use the program disk when you boot the diagnostic.

We strongly recommend that you

- Boot the program disk from a known-good drive.
- Perform the tests in the order listed.
- Use a formatted, blank disk in the drive under test when running the first four tests (Write Protect, Read and Seek, Write and Verify, and Disk Speed).

CAUTION: *Do not insert the reference disk until the drive under test has passed the first four tests. Failure to follow this instruction may cause harm to the reference disk.*

If the drive fails any of the first four tests, return the drive to Apple for a replacement drive. If the drive passes all four tests, then insert the *Apple 5.25 Floppy Drive Test Reference Diskette* and run the last two tests.

Selecting Menu Items

Each screen display prompts you which keys to press to perform various functions—i.e., to select or deselect an option, to move to another menu, etc. If you need more assistance with any menu, press <Command> and ?. The diagnostic displays a Help screen specifically related to the menu displayed when you requested help.

Unbootable Drives

If you are testing a drive that won't boot or you suspect may not be functioning correctly, connect it to the system as drive 2 and boot the diagnostic program disk from drive 1. After the diagnostic has finished booting, use the Select Drive option (Main menu) to select drive 2 as the drive to be tested.

IMPORTANT: *Before using the disks, remove them from the plastic shipping package and leave them (in their protective envelope) on your workbench for 24 hours. Set the disk drive on the workbench several hours before you run the diagnostic. This allows the disks and the drive to adjust to the temperature and humidity of the room. If this precaution is not taken, the diagnostic can give incorrect and unpredictable results.*

Starting Up

1. Place the program disk (*Apple 5.25 Floppy Drive Test)* in a known-good drive and load the diagnostic by turning on the computer. A screen similar to that shown in Figure 3 displays.

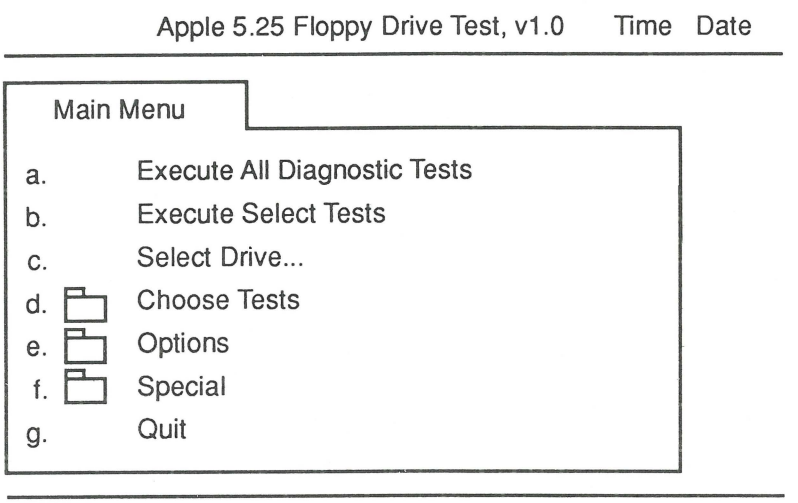

FIGURE 3

2. Remove the program disk.

3. Use the Select Drive option (on the Main menu) to select the appropriate slot and drive number.

   Note: If you have a 3.5-inch drive connected to a Smart Port and a 5.25-inch drive daisy-chained to the 3.5-inch drive, the 3.5-inch drive is considered drive 1 of slot 5 and the 5.25-inch drive is considered drive 1 of slot 6.

4. Insert a formatted, blank, known-good disk in the drive under test.

5. From the Main menu,

   - If you are running all the diagnostic tests, select **Execute All Diagnostic Tests**, then press <Return>. The tests run in the order they appear on the Choose Tests menu.

   - If you are running only certain tests, select those tests from the Choose Tests menu. Return to the Main menu and select **Execute Selected Tests**, then press <Return>. The selected tests run in the order that you chose them.

The Choose Tests Menu

From the Choose Tests menu (see Figure 4), you can select any of the following tests. See "The Tests—What They Do" for a description of each test.

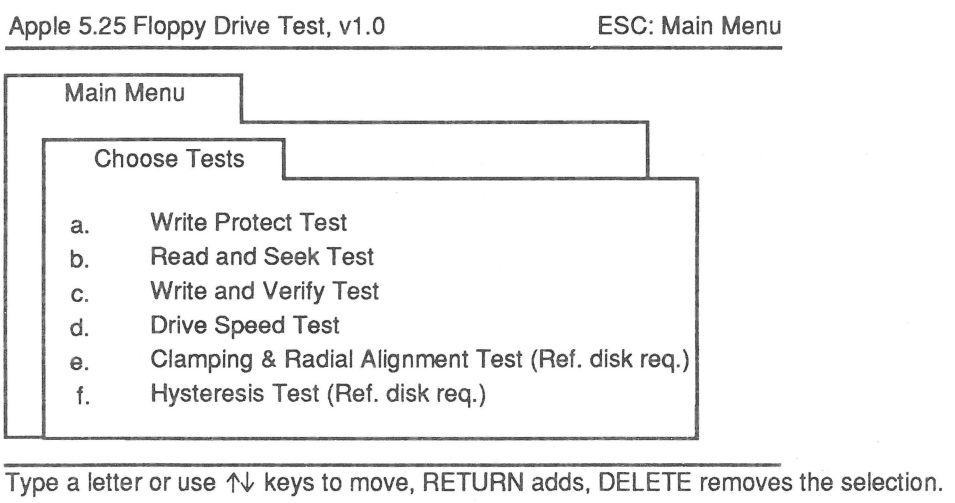

FIGURE 4

Write Protect

The Write Protect test prompts you to remove and reinsert the scratch disk.

Note: During the Write Protect test, the drive light remains illuminated, even while you remove and reinsert the disk.

If the drive is functioning properly, the change in write-protect status (**Drive is write ENABLED** and **Drive is write DISABLED**) displays on the screen. Press <Space> to continue.

If the drive fails the test, the message **NO CHANGE WAS OBSERVED** displays. Try running the test a second time.

If the drive passes on the second attempt, the change in write-protect status displays on the screen. Press <Space> to continue.

If the drive fails again, replace the drive.

Read and Seek

If the drive can accurately position the read/write head at the test tracks and successfully read data from the disk, the diagnostic continues to the next test (if another test is selected); otherwise, the message **Testing finished. Press SPACE to continue** displays.

If the drive cannot accurately position the head, the message **Read and Seek Test Failed** displays.

Write and Verify

If the drive can be written to and read from correctly, the diagnostic continues to the next test (if another test is selected). Otherwise, the message **Testing finished. Press SPACE to continue** displays.

If the drive cannot be written to and read from, the test stops and an error message displays.

Disk Speed

The Disk Speed test displays the relative speed of the disk drive motor.

If the drive speed is within specification throughout the test, the diagnostic continues to the next test (if another test is selected).

If the drive speed is out of specification, refer to the *Apple Service Technical Procedures* manual for directions to adjust the DSPEED (disk speed). If you cannot adjust the disk speed to specification, return the drive to Apple for a replacement.

CAUTION: *Because the software is constantly writing and reading the disk during the Disk Speed test, disks removed during this test will, quite likely, be partially erased. Partially erased disks will either fail to boot the next time they are used or will consistently fail the Read and Seek test (and possibly other tests). For this reason, we strongly recommend that you use a formatted, known-good, blank disk rather than the reference disk when you are running the Disk Speed test.*

Clamping and Radial Alignment

If the Clamping and Radial Alignment test completes successfully, the program proceeds to the next test (if another test is selected) or, if you selected only this test, the message **Testing finished. Press SPACE to continue** displays.

If the screen displays a clamping warning, try removing and reinserting the disk. Press <Space> to rerun the test. If the drive fails again, return it to Apple for a replacement. If the drive passes on the second attempt, the diagnostic proceeds to the next test (if another test is selected). Otherwise, the message **Testing finished. Press SPACE to continue** displays.

If the drive fails, an error message displays. Return the drive to Apple for a replacement.

Hysteresis

If the hysteresis check is performed successfully, the diagnostic returns to the Main menu.

If not, the test stops, the diagnostic returns to the Main menu, and an error message displays.

The Options Menu

Figure 5 shows the Options menu.

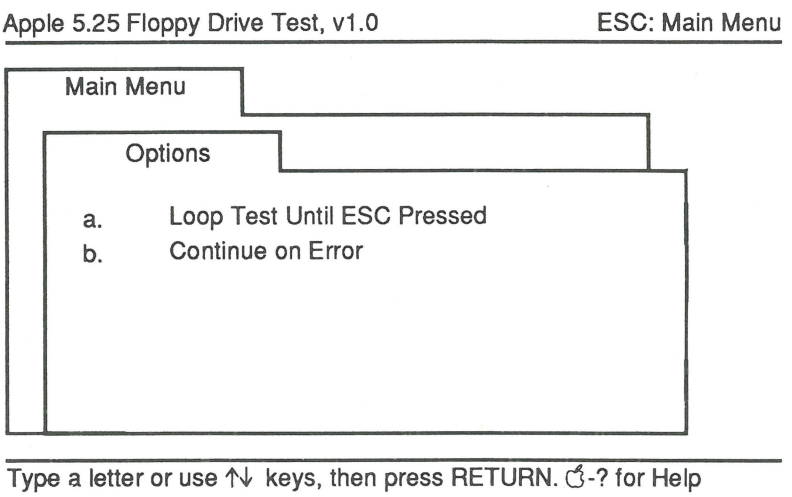

FIGURE 5

The first selection, **Loop Tests Until ESC is Pressed**, causes the diagnostic to continuously cycle through all selected tests. This selection remains in effect until you press <Esc> while a test is running.

The second selection, **Continue on Error**, causes the diagnostic to run all selected tests, even if a test fails. This selection remains in effect until you deselect it on this menu.

Press <Return> to toggle the selection/deselection of the options on this menu.

The Special Menu

Figure 6 shows the Special menu.

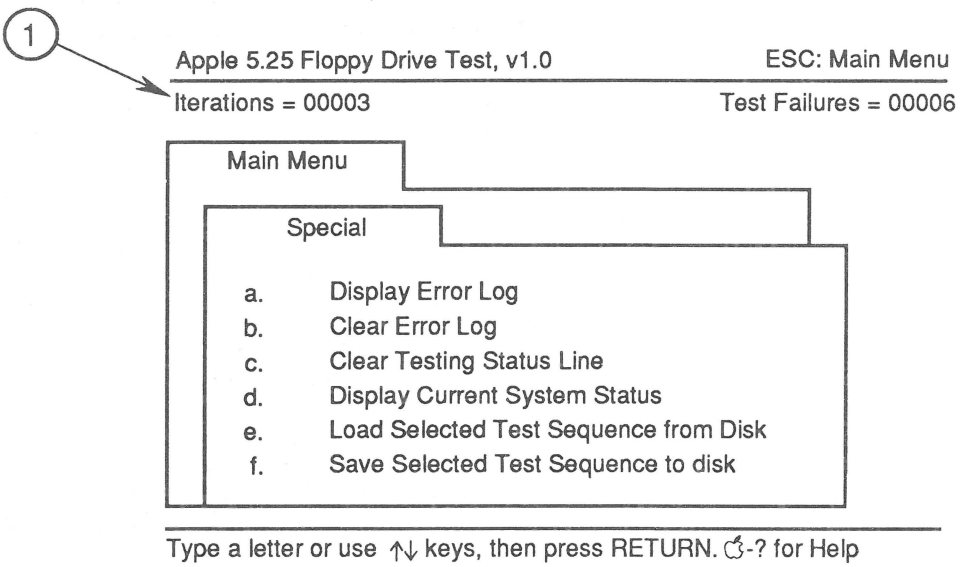

FIGURE 6

The functions available from this menu include the following:

Option	Function
a	Displays the list of errors.
b	Clears the error log and displays the message **Error log cleared. Press SPACE to continue.**
c	Clears the testing status line, which is shown in Figure 6, #1.
d	Displays the current system status, including system type, ROM version, available RAM, and memory card status.
e	Loads the selected test sequence from the disk.
f	Saves the selected test sequence to the disk.

❑ WARNING MESSAGES

Note: You can loop on all tests. However, the Write Protect test cannot be run unattended.

The Write Protect test requires that you remove and reinsert a disk. Therefore, if you want to loop the tests, but you do not want to keep removing and reinserting a disk, you can omit the Write Protect test by using the Choose Tests menu (on the Main menu) to select the tests you want to run. Then, select **Loop Tests Until ESC is Pressed** (on the Options menu), and run the tests by choosing the Execute Selected Tests option (on the Main menu).

This test cannot be run on your program disk. Please remove the program disk and insert a scratch disk.

In order to prevent accidental damage to your program disk, the diagnostic prompts you to remove the program disk. Replace the program disk with a known-good, formatted disk.

WARNING: Diskette is write-protected. Write enable scratch diskette, then press SPACE to continue test.

Remove the write-protect tab from the scratch disk and try again.

Note, a ProDOS error has occurred.

An error occurred while trying to save a test selection to the disk. Make sure the disk is not write-protected.

Unable to test. No drive was found at slot __. Use the "Select Drive" option to verify the slot and drive.

Use the Select Drive menu to choose the correct slot and drive.

Unable to run the Clamping and Radial Alignment Test without the Reference Diskette installed.

If the Reference Diskette is present, check for an open drive door or a damaged Reference Diskette.

Press SPACE to continue testing or ESC to stop testing.

Insert the reference disk in the drive under test when you are running either the Clamping and Radial Alignment test or the Hysteresis test.

An Extended 64K/80 Column Card was not detected. Is the card installed in the Auxiliary Slot? Press Y if installed.

The diagnostic requires an extended 64K/80-column card.

Report the following information on the repair form:

(name of test) Failed

Refer to the Apple Service Technical Procedures.

Press RETURN to restart test sequence...
Press ESC to stop testing.

The drive has failed. Return it to Apple with the information regarding which test(s) failed.

❑ TEST RESULTS

When the diagnostic completes testing, it displays the message **Testing finished. Press SPACE to continue**. If the drive failed a test, the testing status line (see Figure 6, #1) displays the number of test failures.

To view the test results, select the Special menu (from the Main menu) and then the Display Error Log option. The error log lists all the drive's failures that were detected by the diagnostic.

If the drive fails any test, return it to Apple with a list of which test(s) failed. (Be sure to follow the proper packaging procedures when returning the drive—see "Special Packaging and Procedures" in the Product Notices section of the *Service Programs* manual.)

Apple Technical Procedures

Disk IIc

Technical Procedures

❑ TABLE OF CONTENTS

Section 1 – Take-Apart	1.3	Case
	1.5	Analog Card
	1.7	Mechanical Assembly
	1.8	Bezel, Door, and Spring Assembly
	1.10	LED Cable
Section 2 – Adjustments	2.2	DSPEED
Section 3 – Preventive Maintenance	3.2	Introduction
	3.2	Read/Write Head
	3.3	Head Load Button
	3.4	Motor Drive Belt
Section 4 – Illustrated Parts List	4.3	Finished Goods Assembly

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Apple Technical Procedures

Disk IIc

Section 1 – Take-Apart

❑ CONTENTS

1.3 Case
1.5 Analog Card
1.7 Mechanical Assembly
1.8 Bezel, Door, and Spring Assembly
1.10 LED Cable

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in this section.

❑ CASE

Materials Required

#2 Phillips screwdriver

Remove

1. Turn the disk drive upside down.
2. Remove the eight Phillips screws (Figure 1, #1).

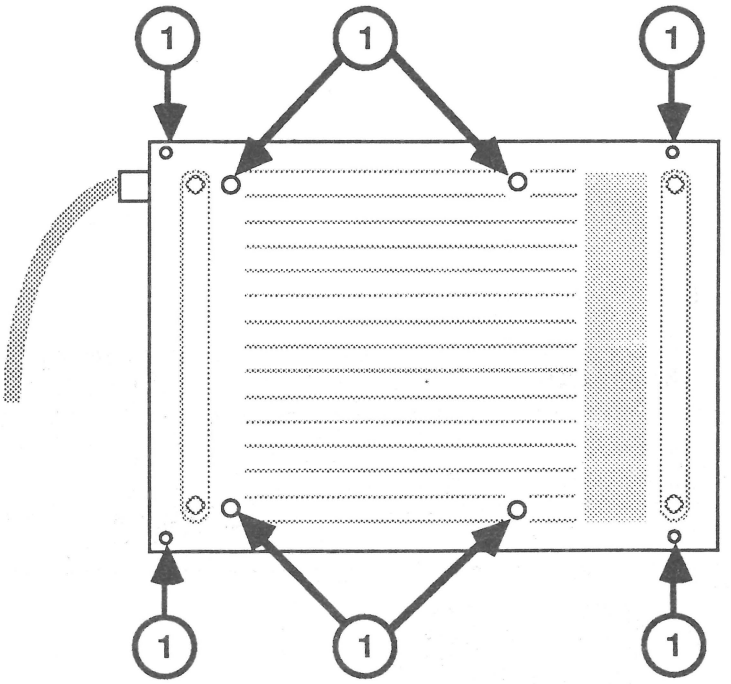


FIGURE 1

3. Hold the case together and turn it over.
4. Remove the top cover.
5. Slip the cable out of the slot in the rear of the case bottom and remove the disk drive from the case.

Replace

1. Place the disk drive into the bottom of the case (shield side up). Carefully route the cable behind the drive and out of the case. The cable grommet should seat into the cut-out in the case.

2. Fit the top cover onto the base.

3. Hold the case together and turn it over.

4. Replace the eight Phillips screws.

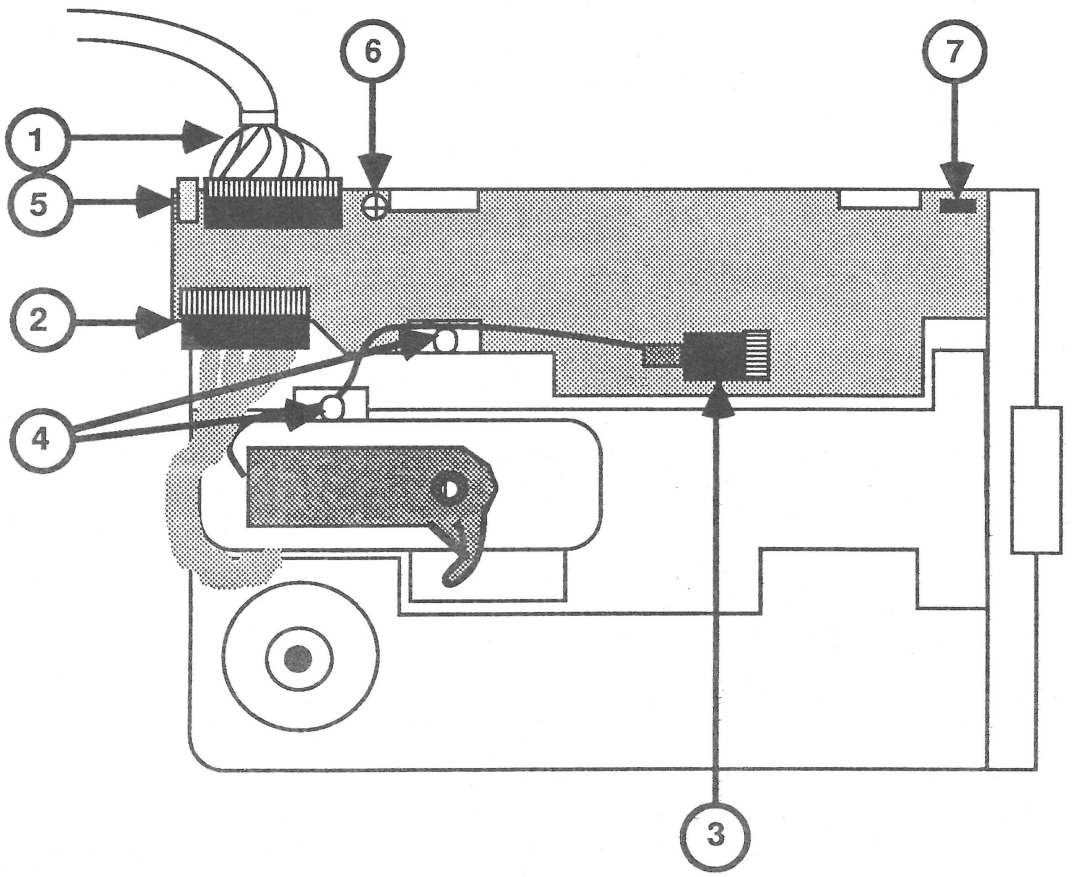


FIGURE 2

❑ ANALOG CARD

Materials Required

#2 Phillips screwdriver

Remove

1. Remove the case.
2. Remove the four Phillips screws, two from either side of the disk drive shield.
3. Remove the cable from the disk drive (Figure 2, #1).
4. Pull up on the shield to remove it from the disk drive.
5. On the analog card, disconnect the motor cable from connector J2 (Figure 2, #2).
6. On the analog card, disconnect the read/write head cable from connector J3 (Figure 2, #3) and carefully remove the wire from the clips (Figure 2, #4).
7. On the analog card, disconnect the LED cable from connector J4 (Figure 2, #5).
8. Remove the Phillips screw that mounts the analog card to the disk drive chassis (Figure 2, #6).
9. Tilt the rear edge of the analog card slightly up and slide the card away from the disk drive.

Replace

1. Slide the front edge of the card under the two plastic posts located on the inside of the disk drive bezel. Lay the card on the chassis so that the alignment tab (Figure 2, #7) protrudes through the hole.
2. Replace the Phillips mounting screw.
3. Look at the read/write head cable (Figure 2, #3) that attaches to connector J3 and note that only four wires are connected to the five pin connector. Connect the read/write head cable, making sure that each wire makes contact with a pin on the header.

4. Position the wire and, if necessary, carefully bend the clips.

5. Connect the motor cable to connector J2. The cable should be oriented so that the end of the connector with the single wire is toward the rear of the disk drive.

6. Connect the small end of the LED cable to connector J4 so that the wires are towards the bottom of the disk drive.

7. Replace the shield and corresponding Phillips screws. Make sure the ground clip is installed at the right-rear position.

8. Replace the disk drive cable. Orient the cable so that the two unused positions are at the front of the connector.

9. Replace the case.

❑ MECHANICAL ASSEMBLY

Materials Required

#2 Phillips screwdriver

Remove

1. Remove the analog card.

2. Replace the shield if returning the mechanical assembly to Apple for exchange.

   Note: The disk drive shield must be installed on the mechanical assembly when the disk drive is sent to Apple for exchange. Also, be sure to remove the LED cable.

Replace

1. Remove the shield if present.

2. Replace the analog card

❑ BEZEL, DOOR, AND SPRING ASSEMBLY

Materials Required

#2 Phillips screwdriver

Remove

1. Remove the case.
2. Remove the four Phillips screws, two from either side of the disk drive shield.
3. Pull up on the shield to remove it from the disk drive.
4. Remove the four Phillips screws that attach the bezel to the disk drive (two screws on each side).
5. Open the disk drive door by pushing inward. As you pull the bezel from the disk drive, hold on to the spring. It is not firmly attached and may fall out.
6. To remove the door from the bezel, simultaneously push it forwards and rotate the rear edge up. Now pull it backwards out of the bezel.
7. Remove the spring from the door.

If Bezel replacement is necessary, additionally perform the steps in "LED Cable" at the end of this section.

Replace

1. Put the door in the bezel (Figure 3, detail A).

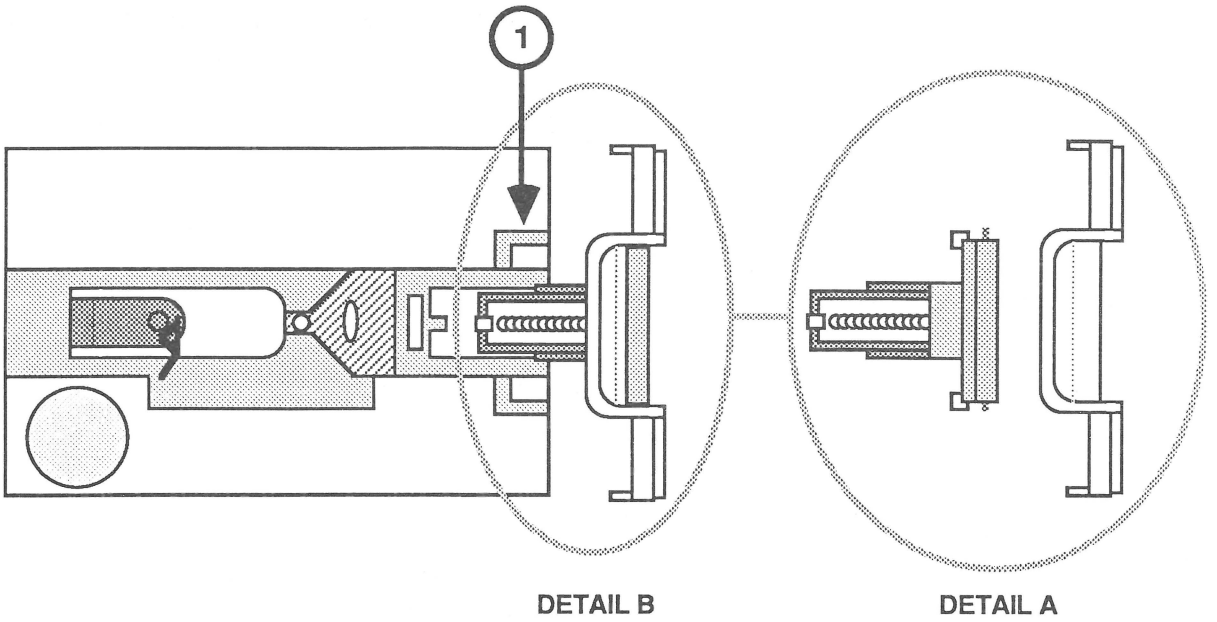


FIGURE 3

2. Hold the door and bezel together. Slide the projecting part of the door partway into the grooves of the hub frame (Figure 3, detail B).

3. As you fit the bezel onto the disk drive:

   a) Push down the hub frame so that its aluminum arms (Figure 3, #1) fit under the top edge of the bezel.

   b) If the analog card is present, make sure that it is held in place under the two tiny posts on the inside of the bezel.

4. Install the spring. It helps to guide the spring with one finger under the disk drive door.

5. Close the disk drive door and put the bezel into place.

6. Replace the Phillips screws that attach the bezel to the disk drive.

7. Replace the shield and corresponding Phillips screws. Make sure the ground clip is installed at the right-rear position.

8. Replace the disk drive cable. Orient the cable so that the two unused positions are at the front of the connector.

9. Replace the case.

❑ LED CABLE

Materials Required

Jeweler's flatblade screwdriver

Remove

1. Remove the bezel.

2. Press the face of the LED towards the rear of the bezel, while gently prying apart the LED holder with the screwdriver. Do this until the LED snaps free of the bezel.

Replace

1. Slip the LED back into its holder and snap it into place.

   Note: This is easier if the flat edge on the LED is aligned with one of the two openings in the holder and support the holder from the front with your fingers.

2. Route the cable as shown in Figures 4, #1 and 5, #1.

3. Replace the bezel.

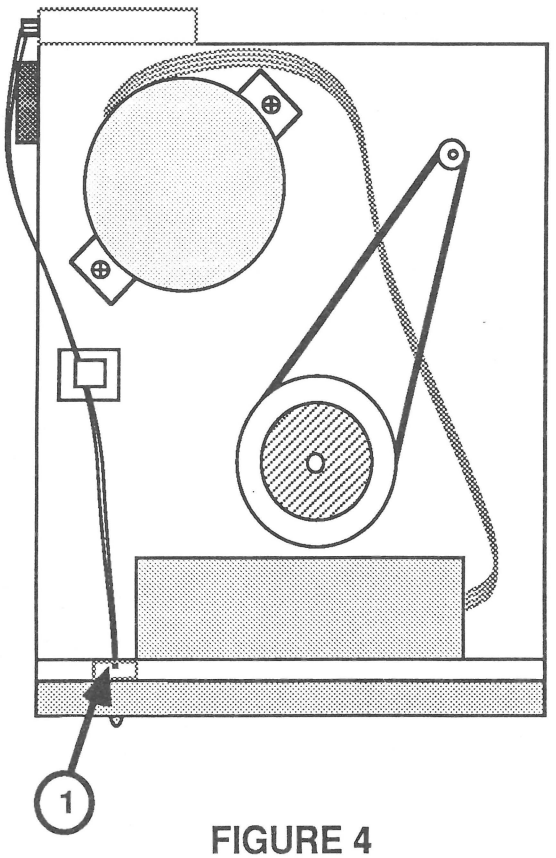


FIGURE 4

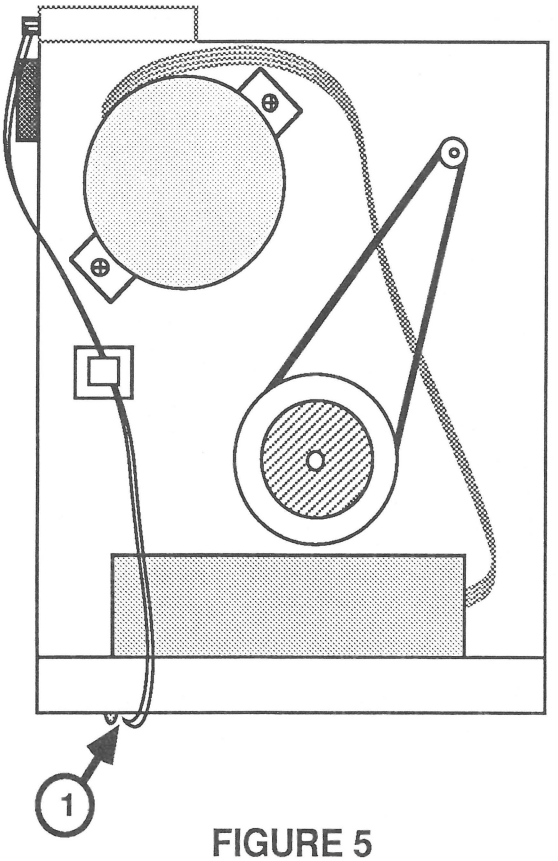


FIGURE 5

Apple Technical Procedures

Disk IIc

Section 2 – Adjustments

❑ CONTENTS

2.2 DSPEED

Note: If a step is underlined, detailed instructions for that step can be found in Section 1, Take-Apart.

❑ DSPEED

This adjustment procedure was written to be used with the *5.25 Floppy Drive Test Assembly*—if the test indicates that you need to adjust the drive speed. All information on setting up and running the diagnostic is in the *Multi-Product Diagnostics Technical Procedures*, Section 2, 5.25-Inch Floppy Drive Test.

Materials Required

Multi-Product Diagnostics Technical Procedures manual
A small (jeweler's) flat-blade screwdriver
Apple IIc with video display
The Disk IIc to be adjusted

Making the Adjustment

To adjust the DSPEED (drive speed):

1. Remove the Disk IIc case.

2. Start the Drive Speed test (see the *Multi-Product Diagnostics Technical Procedures*, Section 2, 5.25-Inch Floppy Drive Test.).

3. Turn the drive upside down, and locate the DSPEED adjustment screw, VR1, on the printed circuit board.

   Note: When you make the DSPEED adjustment, keep the disk drive flat.

4. The adjustment is extremely sensitive, so turn the adjustment screw very slowly. The indicator on the screen will move back and forth to show changes in speed.

5. Adjust the speed so that the indicator is within the "good" range—as close to 0 as possible. Let the test run for 30 seconds.

6. Press <Escape> to return to the main menu; then repeat the test.

   Does the DSPEED now stay within the "good" range?

   - Yes—Press <Escape> to return to the main menu.

   - No—If the DSPEED cannot be properly adjusted, return the faulty mechanical assembly to Apple.

Apple Technical Procedures

Disk IIc

Section 3 – Preventive Maintenance

❑ CONTENTS

3.2 Introduction
3.2 Read/Write Head
3.3 Head Load Button
3.4 Motor Drive Belt

Note: If a step is underlined, detailed instructions for that step can be found in Section 1, Take-Apart.

❑ INTRODUCTION

The read/write head should be cleaned any time the computer or disk drive is being serviced. The head load button should be replaced whenever it is worn or dirty. The drive motor belt should be inspected any time the disk drive is being serviced.

❑ READ/WRITE HEAD

Materials Required

#2 Phillips screwdriver
Cotton swabs
Isopropyl Alcohol (80% alcohol/20% water)

Procedure

To service the read/write head:

1. Remove the case and drive shield.
2. Clean the guide rails with the isopropyl alcohol. **Do not** use grease.
3. Inspect the head for worn or dull spots in the ceramic. If you find any, replace the mechanical assembly.
4. Clean the head with the isopropyl alcohol.
5. Move the read/write head assembly back and forth along the full length of its travel. Check for any blockage or friction. If there is any, replace the mechanical assembly.
6. Replace the drive shield and case.

❑ HEAD LOAD BUTTON

Materials Required

#2 Phillips screwdriver
Needlenose pliers
Head load button

Procedure

To service the head load button:

1. Remove the case and drive shield.

2. Lift up the head load arm. If the head load button is worn or dirty, squeeze the top part of the load button with small needlenose pliers, and let the button drop down.

3. Insert the new load button through the hole in the shield plate and into the head load arm. Press the button until it snaps into place.

4. Replace the drive shield and case.

❑ MOTOR DRIVE BELT

Materials Required

#2 Phillips screwdriver
Motor drive belt

Procedure

To service the motor drive belt:

1. Remove the case.
2. Turn the drive upside down and locate the belt. Inspect the belt for cracks, slippage, and elasticity. If the belt is dry or cracked, or if it slips, continue with step 3.
3. Slip the belt off the pulley.
4. Place the new belt around the motor spindle and then slip it around the pulley.
5. Replace the case.

Apple Technical Procedures

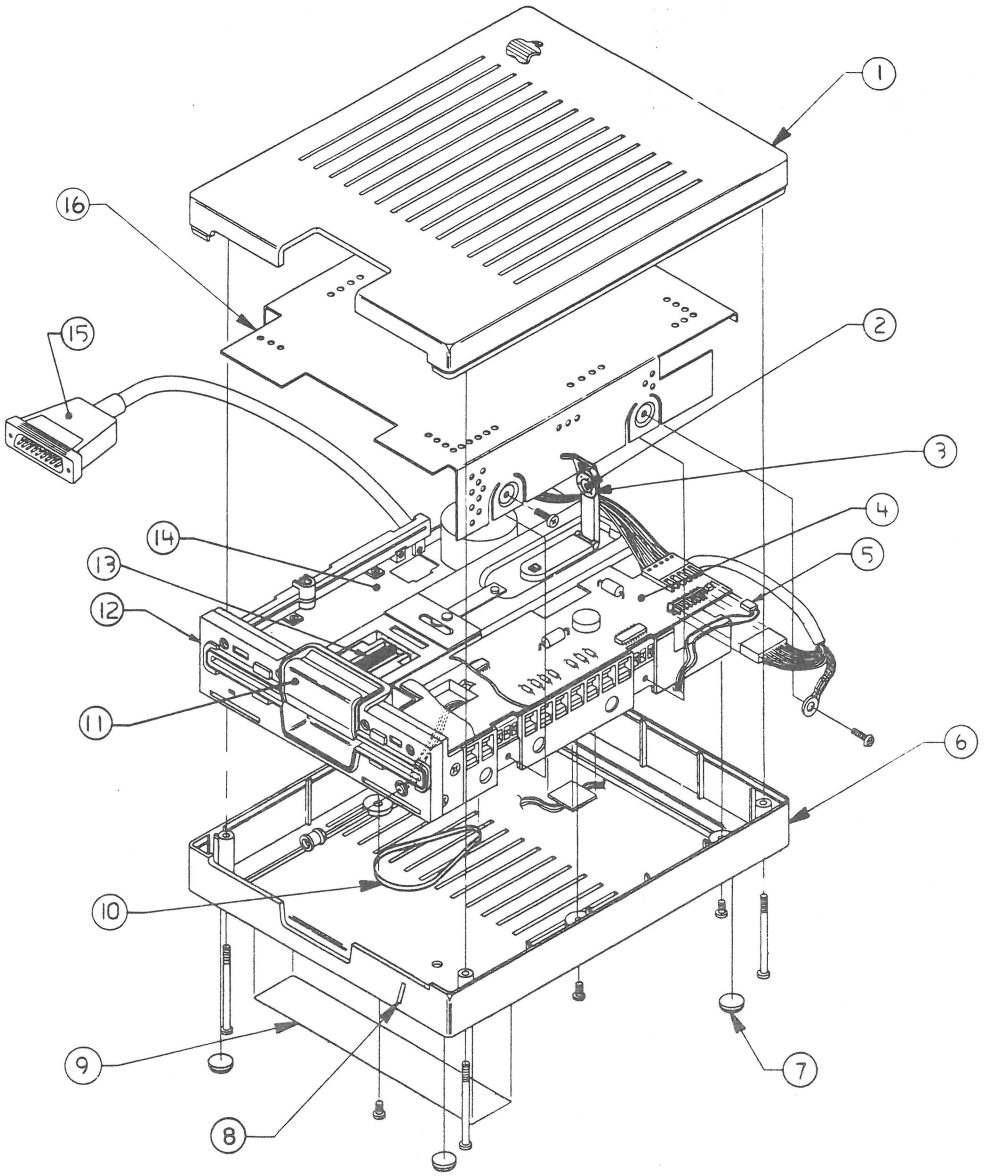
Disk IIc

Section 4 – Illustrated Parts List

❑ CONTENTS

4.3 Finished Goods Assembly (Figure 1)

The figure and list in this section include all piece parts that can be purchased separately from Apple for the Disk IIc, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs Manual* for prices.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16

❑ DISK IIc – FINISHED GOODS ASSEMBLY (Figure 1)

Item	Part No.	Description
1	655-5006	Top Case Assembly, External Drive IIc
2	U815-0064	Load Button
3	805-5038	Upper Head Shield Plate
4	661-0265	Apple IIc Analog Board
5	590-0221	Disk IIc LED Cable
6	655-5007	Bottom Case Assembly, External Drive IIc
7	865-0021	Bumper Foot
8	815-0836	Disk IIc LED Lens
9	655-5005	Label, External Disk Drive IIc
10	U880-0002	Disk Drive Belt
11	815-0811	Disk Drive Door (Latch), Beige
	815-0587	Disk Drive Door (Latch), Platinum
12	815-0810	Disk Drive Bezel
13	870-0023	Spring
14	661-0264	Apple IIc Drive Mechanism
15	590-0212	Disk IIc Cable
16	805-0756	Disk IIc Top Shield

Apple Technical Procedures

UniDisk 3.5

Technical Procedures

❑ TABLE OF CONTENTS

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	0.4	Removing Diskettes Which Will Not Eject
Section 1 – Basics	1.3	Introduction.
	1.3	Drive Mechanism Packaging
Section 2 – Diagnostics-	2.3	Introduction.
	2.4	Formatting and Copying
	2.6	Booting From the UniDisk 3.5
	2.7	Saving and Deleting
Section 3 – Troubleshooting	3.3	Things to Remember
	3.4	UniDisk 3.5 Symptom Chart
Section 4 – Take-Apart	4.2	Bottom Cover
	4.3	Top Cover
	4.5	Controller Card
	4.8	Drive Mechanism
Illustrated Parts List	IPL.3	Exploded View (Figure 1)
	IPL.5	Service Packaging, 800K/1.4 MB Drives (Figure 2)

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UniDisk 3.5 Technical Procedures

Section 0

Service Notes

Contents:

Diskette Ejection Problems.....0.3
  Removing Diskettes Which Will Not Eject.....0.5

DISKETTE EJECTION PROBLEMS

Whenever a diskette from a UniDisk 3.5 does not fully eject, the user must push the diskette back in and attempt to eject it electronically. This can be done by pressing the Eject button on the front of the UniDisk. The user should attempt this two or three times. As a last resort, the user can insert a large paper clip in the pin hole located to the right of the slot where the diskette is inserted.

IMPORTANT: Once the diskette becomes "frozen" and does not fully eject, the user must NOT force the diskette by pulling it out from the drive. Doing so can cause possible damage to the disk drive mechanism. If the user has tried to forcibly remove the diskette from the disk drive, refer to "Removing Diskettes Which Will Not Eject" below.

In addition to the precautions discussed above, the user should be aware of other factors which can affect the insertion and ejection of a diskette.

- A diskette should be inserted by pressing the diskette gently into the drive. Avoid grasping and pushing the diskette, as this may cause the diskette to go in only part way and stop. If this happens the user should attempt to eject the diskette as described above.

- Diskettes which contain three or more labels may not slide easily into and out of the diskette slot in the UniDisk case. Should a third label be required, either the other labels should be removed first or the diskette should be discarded.

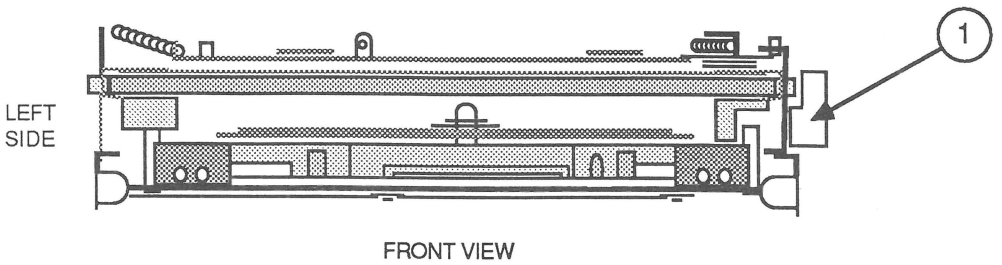


FIGURE 1

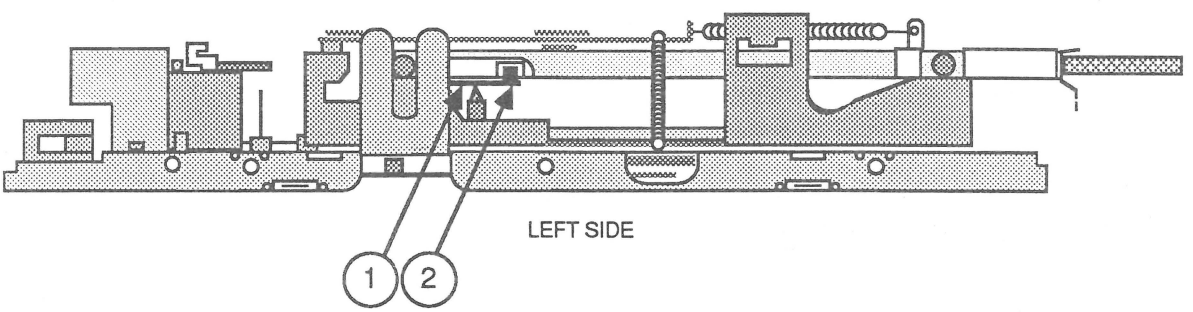


FIGURE 2

Removing Diskettes Which Will Not Eject

If a diskette becomes "jammed" in a customer's disk drive, the following procedure should be used to remove it prior to returning the disk drive.

1. Remove the disk drive mechanism. (See **Section 4, Take-Apart.**)

2. Place the disk drive mechanism on a flat surface, with the Printed Circuit Board facing down and the diskette opening facing you (see Figure 1).

3. If the diskette is not already fully inserted into the disk drive, push it in until it is properly seated.

4. Press the eject lever at the right side of the disk drive (see Figure 1, #1).

5. Turn the disk drive so that the left side is facing you.

6. Locate the small arm with a cylindrical cog at its end. This arm is located near the left-to-right center of the drive mechanism (see Figure 2, #1). This cog will be caught in the half-moon depression of the diskette case.

7. Insert a small screwdriver at the position shown in Figure 2, #2 and **gently** move the arm away from the diskette until the diskette pops forward slightly. Remove the diskette from the disk drive.

8. Return the defective disk drive to Apple and follow the instructions in **Section 4, Take-Apart,** to replace the disk drive with a new unit.

UniDisk 3.5 Technical Procedures

Section 1

Basics

INTRODUCTION

The UniDisk™ 3.5 disk drive is a double-sided drive providing 800 kilobytes of storage per diskette for the Apple® IIe and IIc personal computers. Using the ProDOS® Operating System, UniDisk 3.5 can easily transfer formatted data files between the 5 1/4" diskettes and the 3.5" higher capacity diskettes.

NOTE: Refer to **Drive Compatibility** under the **Disk Drives** tab to find out which of the Apple 3.5-inch 800K drive mechanisms may be used in the UniDisk 3.5.

DRIVE MECHANISM PACKAGING

When sending the drive mechanism in for exchange, it **MUST** be shipped in the Apple-approved packaging, which includes the shipping fixture (800K shield for the internal drive) and the protective packaging disk. Refer to **Section 5, Illustrated Parts List,** for drawings and part numbers of these items.

UniDisk 3.5 Technical Procedures

Section 2

Diagnostics

Contents:

Introduction.....2.2
Formatting and Copying.....2.2
Booting From the UniDisk 3.5.....2.4
Saving and Deleting.....2.5

INTRODUCTION

The ProDOS User's Diskette will be used for testing the various functions of the UniDisk 3.5. This section is divided into three procedures. The first procedure will have you format a diskette in the UniDisk 3.5 and copy two files from the 5 1/4" ProDOS User's Diskette onto the formatted diskette in the UniDisk 3.5. The second procedure will have you boot directly from the UniDisk 3.5 using the boot diskette you just created. The third procedure will have you save and delete a file from the same diskette. If the UniDisk 3.5 displays any problems with these procedures, turn to **Section 3, Troubleshooting.**

If you are using the Apple IIc, the Monitor ROM upgrade must be installed for compatibiliy with the UniDisk 3.5 (refer to **Apple IIc Technical Procedures** for Monitor ROM upgrade procedures).

The Apple IIe must have the UniDisk 3.5 interface card installed.

NOTE: Refer to the ProDOS Users Manual if you are unfamiliar with ProDOS. If you prefer you may use AppleWorks after you have formatted the 3.5" diskette under ProDOS. Using AppleWorks, you can select the ProDOS prefix of the formatted 3.5" diskette and use the UniDisk 3.5 for the storage device.

FORMATTING AND COPYING

1. On the Apple IIe, install a 5 1/4" disk drive into slot 6.

   On the Apple IIc, use the internal 5 1/4" disk drive.

2. On the Apple IIe, install the UniDisk 3.5 interface card into slot 5 and connect the UniDisk 3.5.

   On the Apple IIc, connect the UniDisk 3.5 to the external drive port. It will be recognized as slot 5, drive 1.

3. Insert the ProDOS User's Diskette into the 5 1/4" disk drive. Power on the system.

   The main menu will appear.

4. Type **F** for ProDOS **Filer.**

   The **Filer** main menu will appear.

5. Type **V** for **Volume Commands.**

   The **Volume Commands** Menu will appear.

6. Type **F** for **Format a Volume.**

   A screen will appear asking which volume you wish to format.

7. On both the Apple IIe and the Apple IIc, type **5** and press **<RETURN>.**

   You have specified slot 5, drive 1.

8. Type in **TEST** as the volume name and press **<RETURN>.**

   A warning will appear on the screen notifying you that you are about to format a large volume.

9. Press **<RETURN>.**

   The UniDisk 3.5 will whirr. When the red light goes off, the formatting is complete.

10. Press **<ESC>.**

    The **Filer** menu will appear.

11. Type **F** for **File Commands.**

    The **File Command** menu will appear.

12. Type **C** for **Copy Files.**

    The **Copy Files** screen will appear. You will need to transfer two files from the ProDOS User's Diskette to the UniDisk 3.5 diskette.

13. For the first **PATHNAME:** enter **/USERS.DISK/PRODOS** and press **<RETURN>.**

14. For the second **TO PATHNAME:** enter **/TEST/PRODOS** and press **<RETURN>.**

15. Press **<RETURN>**.

    The drives will whirr and the file **ProDOS** will be copied from the ProDOS User's Diskette to the UniDisk 3.5 diskette named Test. The message **Copy Completed** will be displayed.

16. For the first **PATHNAME:** enter **/USERS.DISK/BASIC.SYSTEM** and press **<RETURN>**.

17. For the second **TO PATHNAME:** enter **/TEST/BASIC.SYSTEM** and press **<RETURN>**.

18. Press **<RETURN>**.

    The drives will whirr and the file **Basic.System** will be copied from the ProDOS User's Diskette to the UniDisk 3.5 diskette named Test. The message **Copy Completed** will be displayed.

19. Power off the system.

BOOTING FROM THE UNIDISK 3.5

Apple IIe

1. Remove the 5 1/4" disk drive interface from slot 6. Power on the system.

   The screen will display **Apple II,]** and the cursor.

2. Enter **PR#5** and press **<RETURN>**.

   The UniDisk 3.5 will come on. The screen will display **PRODOS BASIC 1.1,]** and the cursor.

Apple IIc

1. Remove the ProDOS User's Diskette from the internal drive. Power on the system.

   The UniDisk 3.5 will come on. The screen will display **PRODOS BASIC 1.1,]** and the cursor.

The UniDisk 3.5 has now been booted. Continue to the next procedure.

SAVING AND DELETING

1. Enter the following program, pressing **<RETURN>** after each line of text entered.

```
NEW
10 PRINT "SAVING AND DELETING TO THE UNIDISK 3.5."
20 PRINT "THIS IS A TEST."
30 END
```

2. Type in **SAVE TEST1** and press **<RETURN>**.

   The UniDisk 3.5 will come on and whirr. Wait until the drive light goes out before continuing.

3. Type in **CATALOG** and press **<RETURN>**.

   The screen should show the following:

```
 NAME           TYPE  BLOCKS  MODIFIED         CREATED          ENDFILE SUBTYPE

*PRODOS          SYS      30  18-SEP-84  0:00  <NO DATE>          14848
*BASIC.SYSTEM    SYS      21  18-JUN-84  0:00  <NO DATE>          10240
 TEST1           BAS       1  <NO DATE>        <NO DATE>             20

BLOCKS FREE: 1541     BLOCKS USED:   59     TOTAL BLOCKS: 1600
```

4. Type in **DELETE TEST1** and press **<RETURN>**.

   The UniDisk 3.5 will come on and whirr. Wait until the drive light goes out before continuing.

5. Type in **CATALOG** and press **<RETURN>**.

   The screen should show the following:

```
 NAME           TYPE  BLOCKS  MODIFIED         CREATED          ENDFILE SUBTYPE

*PRODOS          SYS      30  18-SEP-84  0:00  <NO DATE>          14848
*BASIC.SYSTEM    SYS      21  18-JUN-84  0:00  <NO DATE>          10240

BLOCKS FREE: 1542     BLOCKS USED:   58     TOTAL BLOCKS: 1600
```

6. Repeat the saving and deleting twice to ensure there is no problem with the UniDisk 3.5.

IF THE UNIDISK 3.5 IS ABLE TO ACCOMPLISH THE ABOVE PROCEDURES WITHOUT PROBLEMS, THE UNIDISK 3.5 IS FUNCTIONING PROPERLy.

UniDisk 3.5 Technical Procedures

Section 3

Troubleshooting

Contents:

Things to Remember.....3.2
UniDisk 3.5 Symptom Chart.....3.3

THINGS TO REMEMBER

1. When exchanging a drive mechanism, you must package it as specified in **Section 1, Basics.**

2. The UniDisk 3.5 will only work with ProDOS based applications and files.

3. The Apple IIc **MUST** have the Monitor ROM upgrade to work correctly with the UniDisk 3.5. Refer to the **Apple IIc Technical Procedures** for Monitor ROM upgrade procedures.

4. The Apple IIc recognizes the UniDisk 3.5 as being in slot 5, drive 1.

5. The Apple IIe must use the UniDisk 3.5 Apple IIe Interface Card to connect to the UniDisk 3.5. The location of the interface card determines the slot assignment.

UNIDISK 3.5 SYMPTOM CHART

The UniDisk 3.5 has three replaceable exchange modules (the drive mechanism, the controller board, and the interface card for the Apple IIe) and three replacement parts (the external drive cable, the micro-switch eject cable assembly, and the LED cable assembly).

Two general rules for troubleshooting the UniDisk 3.5 are:

1. Use known-good software. (It can save you a lot of time!)

2. Be sure you are addressing the correct slot (refer to #4 and #5 in **Things to Remember**).

If the UniDisk 3.5 demonstrates a symptom listed below, replace the module or part listed under the corrective action(s) in the order listed. If a corrective action does not fix the problem, the original board should be reinstalled before you perform the next step.

SYMPTOM	CORRECTIVE ACTION
Drive will not come on. LED flashes once or does not light.	1. Swap interface card (IIe) 2. Swap controller card 3. Swap drive mechanism 4. Swap external drive cable 5. Swap LED assembly
Drive will read but not write.	1. Swap drive mechanism 2. Swap controller card 3. Swap interface card (IIe) 4. Swap external drive cable
Drive will not read, but LED comes on.	1. Check software 2. Swap drive mechanism 3. Swap controller card 4. Swap interface card (IIe)
Drive will not eject diskette.	1. Refer to "Diskette Ejection Problems" in **Section 0, Service Notes** 2. Swap drive mechanism 3. Swap micro-eject switch assembly

UNIDISK 3.5 SYMPTOM CHART (Continued)

Drive functions, but LED is not lit.	1. Swap LED assembly 2. Swap drive mechanism 3. Swap controller card

Apple Technical Procedures

UniDisk 3.5

Section 4 – Take-Apart

❑ CONTENTS

4.2 Bottom Cover
4.3 Top Cover
4.5 Controller Card
4.8 Drive Mechanism

❑ BOTTOM COVER

Materials Required

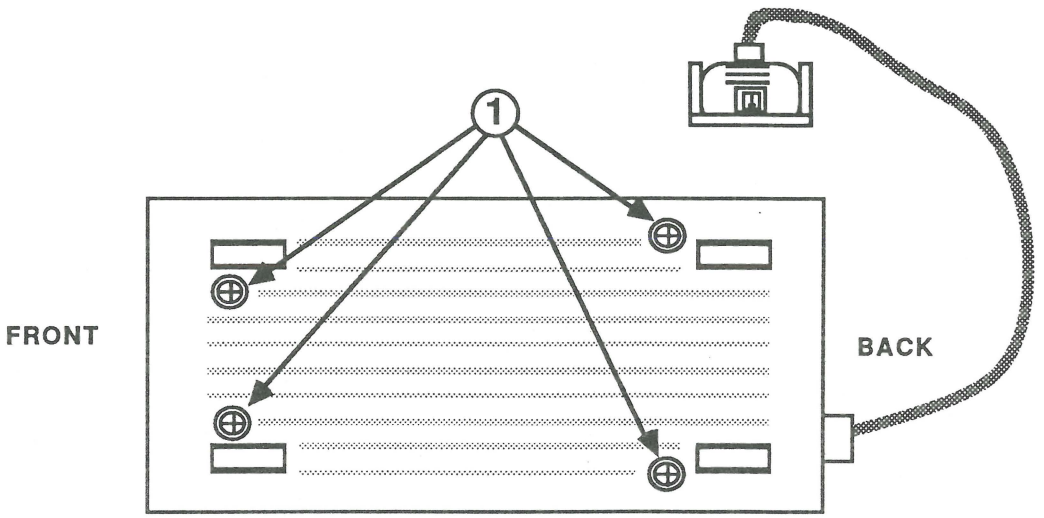
#2 Phillips screwdriver, magnetized

Remove

1. Set the UniDisk 3.5 upside down.
2. Remove the four screws (Figure 1, #1).
3. Hold the external cable in place, and lift the bottom panel off.

Replace

1. Position the bottom cover, hold the external cable, and slide the bottom cover into place.
2. Replace the four screws (Figure 1, #1).



BOTTOM VIEW

FIGURE 1

❑ TOP COVER

Materials Required

#2 Phillips screwdriver, magnetized
Small flathead screwdriver
Small needlenose pliers

Remove

1. Remove the bottom cover.

2. Washers with black wire guides connected to them are held in place by two screws (Figure 2, #1). Bend the black wire guide on top of each screw out of the way, and remove the two screws.

3. Remove the four small black rubber guides (Figure 2, #2) from the sides of the case with needlenose pliers.

4. **Without pulling on the wires,** disconnect the eject button connector (Figure 2, #3). If necessary, gently pry off the connector with a small flathead screwdriver.

5. Lift the entire metal case from the top cover.

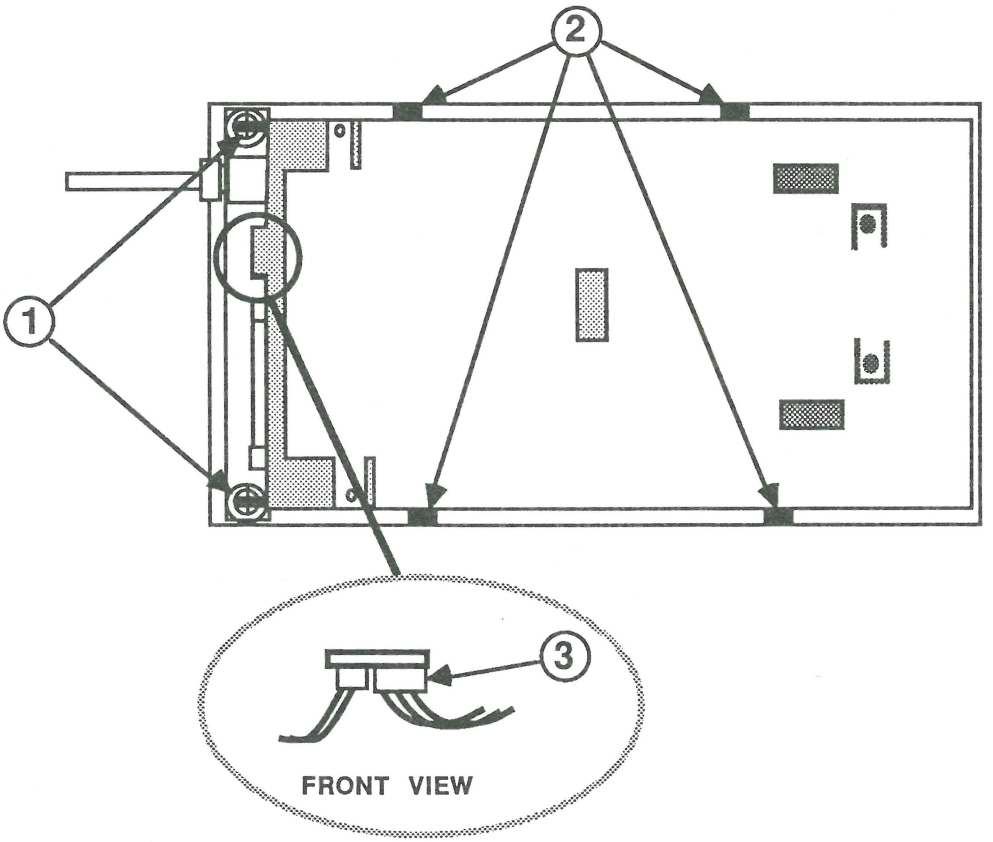


FIGURE 2

Replace

1. Position the metal case onto the top cover. There is a hole in the upper RFI shield that fits over a plastic tab located toward the front of the top cover. Be sure the LED and eject button wires can be seen on each side of the case.

2. Replace the two screws and the washers with the black guides to hold the wires in position.

3. Replace the four black rubber guides to hold the wires in position.

4. Connect the eject button connector.

5. Bend the black guides over the wires and the screws.

6. Replace the bottom cover.

❑ CONTROLLER CARD

Materials Required

#2 Phillips screwdriver, magnetized
Small flat-head screwdriver
Small needlenose pliers

Remove

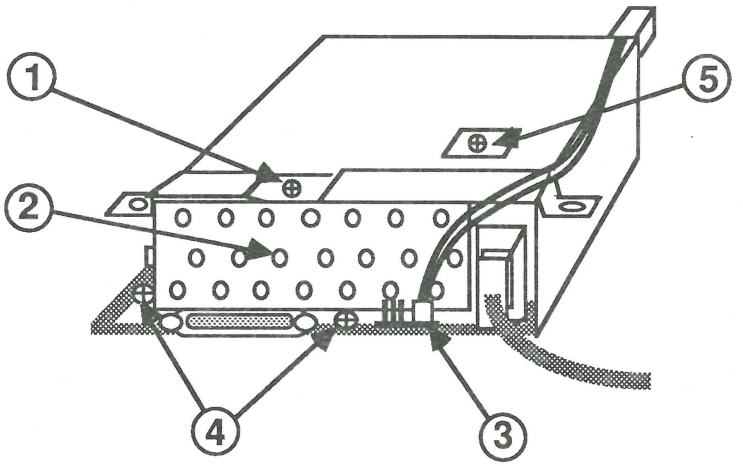
1. Remove the bottom cover and the top cover.

2. Remove the one screw (Figure 3, #1) that holds the small metal shield in position (Figure 3, #2). Remove the shield.

3. **Without pulling on the wires,** disconnect the LED connector (Figure 3, #3). If necessary, gently pry off the connector with a small flat-head screwdriver.

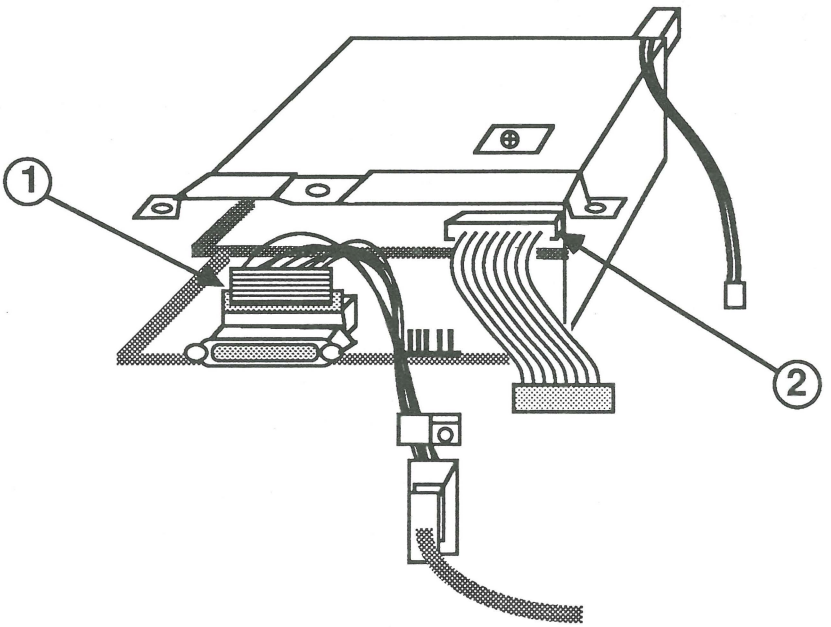
4. Remove the two screws that hold the controller card in place (Figure 3, #4).

5. Note the positioning and remove the one screw that holds the interface cable grounding clip in position (Figure 3, #5).



BACK VIEW

FIGURE 3



BACK VIEW

FIGURE 4

6. Slide the controller card halfway out and disconnect the interface connector from the controller board (Figure 4, #1).

7. Remove the cable connector plug from the analog board (Figure 4, #2). This will free the cable soldered to the controller card.

8. Slide out the controller board.

Replace

1. Slide the controller board halfway in. The board should be on top of the guides in the RFI shield.

2. Connect the cable connector to the analog board mounted on the mechanical assembly (Figure 4, #2).

3. Connect the interface cable to the controller board (Figure 4, #1).

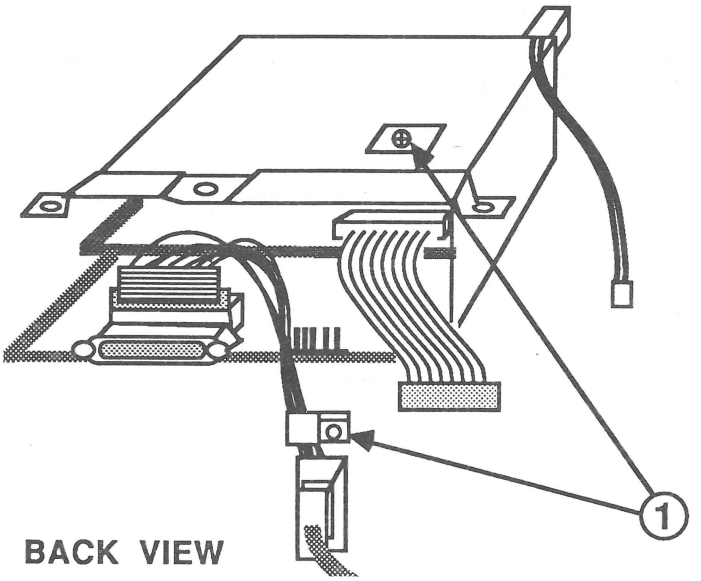


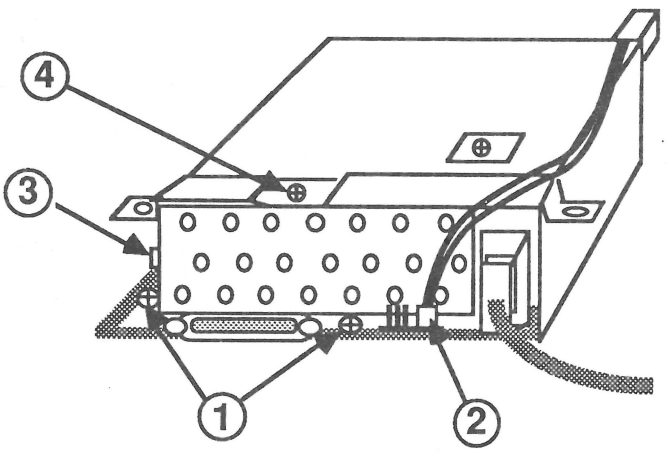
FIGURE 5

4. Slide the controller board into the assembly. Place the interface cable grounding clip on the exposed metal casing on the interface cable. Using a small pair of needlenose pliers, position the clamp onto the screw mount and replace the screw (Figure 5, #1).

5. Replace the two screws (Figure 6, #1) that hold the controller card in place, and connect the LED connector.

6. Insert the tab on the left of the small shield (Figure 6, #3) into the slot on the left of the RFI shield and replace the screw holding it (Figure 6, #4).

7. Replace the top and the bottom covers.



BACK VIEW

FIGURE 6

❑ DRIVE MECHANISM

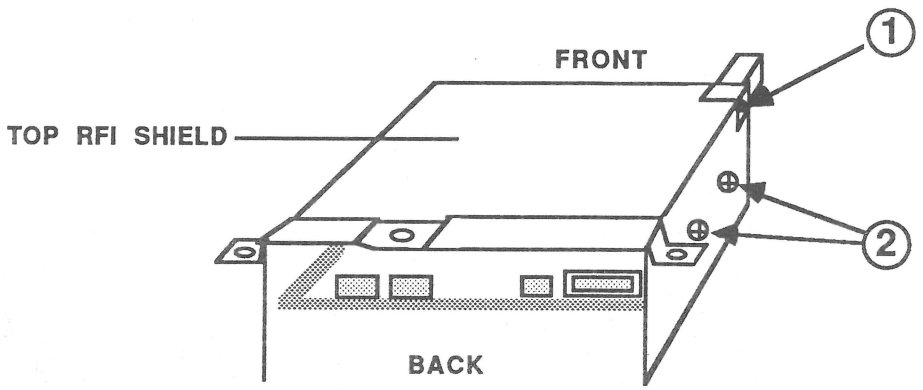
Materials Required

#2 Phillips screwdriver, magnetized
Small Phillips screwdriver

Remove

1. Remove both the bottom and top covers.
2. Remove controller card.
3. Using the small Phillips screwriver, remove the screw that holds the LED in position (see Figure 7, #1).
4. Remove the four screws that hold the disk drive mechanism in the RFI shield. There are two screws on each side of the shield. Figure 7, #2, shows one side.
5. Slide the drive out toward the front of the shield.

Note: All 3.5-inch, 800K disk drives are shipped in Apple-approved packaging-and-shipping fixtures. Before sending in the drive mechanism for exchange, be sure to install the shipping fixture and the protective packaging diskette. See Section 5, Illustrated Parts List, for more packaging information.



DRIVE MECHANISM

FIGURE 7

Replace

1. If necessary, remove the new drive assembly from the shipping fixture. Position the RFI shield top-up and slide the drive assembly, connectors first, into the shield. The drive mechanism fits snugly between the screw mounts on the RFI shield.

2. Start the four screws that hold the disk drive mechanism to the RFI shield. After all four screws are started, tighten each one. There are two screws on each side of the shield. Figure 7, #2 shows one side.

3. Position the LED so it is facing the front and the screw hole lines up with the RFI shield screw hole (Figure 7, #1). Replace the screw using the small Phillips screwdriver.

4. Replace the controller card.

5. Replace the top and the bottom covers.

Apple Technical Procedures

UniDisk 3.5

Illustrated Parts List

❑ CONTENTS

IPL.3 Exploded View (Figure 1)
IPL.5 Service Packaging, 800K/1.4 MB Drives (Figure 2)

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the UniDisk 3.5 Drive, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs Manual* for prices.

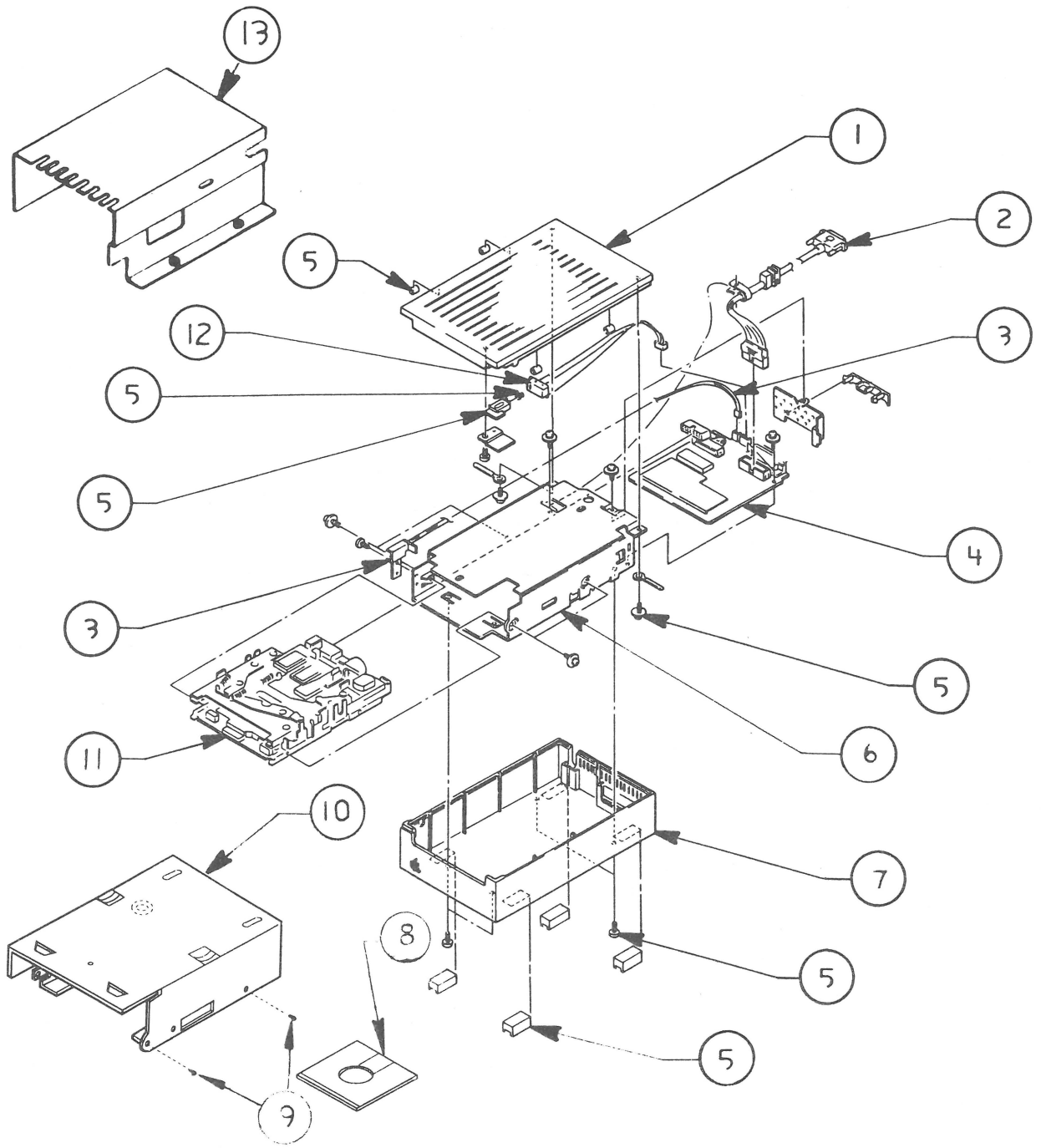


FIGURE 1

❑ EXPLODED VIEW (Figure 1)

Item	Part No.	Description
1	815-0904	Case Top, UniDisk 3.5
2	590-0321	External Drive Cable
3	590-0100	LED Cable Assembly
4	661-0307	UniDisk 3.5 Controller Card
5	076-0192	Parts Set, UniDisk 3.5
6		RFI Shield—not available
7	815-0905	Case Bottom, UniDisk 3.5
8	003-0003	Packing Disk, 2-sided (for transporting)
9	462-3401	Screw, M3 x 6, with two washers
10	805-5050	Floppy Metal Housing (for transporting)
11	661-0345	800K Mechanism, Apple 3.5 Drive
12	590-0101	Microswitch Eject Cable Assembly
13	805-0217	800K Internal Drive Shield (for transporting)

The floppy metal housing for transporting is required when using using 1.4MB drive packaging.

The 800K internal drive shield for transporting is required when using 800K drive packaging.

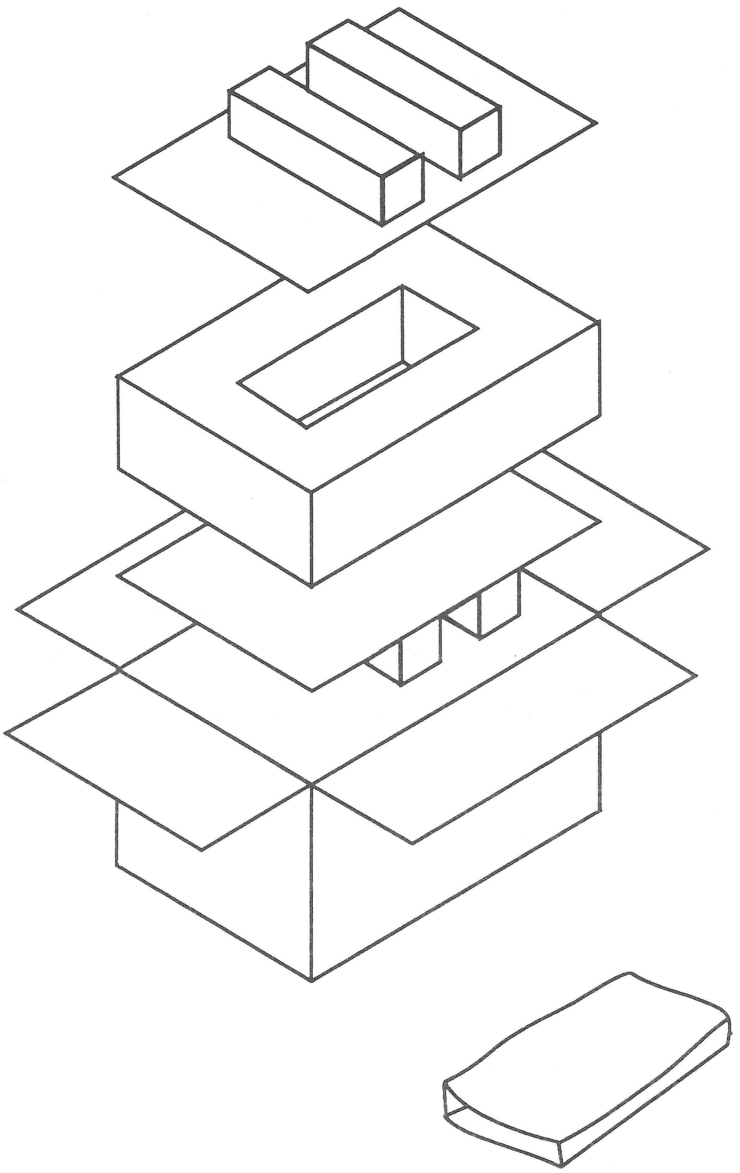


FIGURE 2

❑ SERVICE PACKAGING, 800K/1.4 MB DRIVES (Figure 2)

Item	Part No.	Description
–	602-0210	Service Packaging, 800K/1.4 MB Drives

Apple Technical Procedures

Apple 5.25 Drive / UniDisk

Technical Procedures

❑ TABLE OF CONTENTS

Section 1 – Basics	1.2	Product Description
	1.2	Model Comparison
	1.2	Connecting the Drives
Section 2 – Take-Apart	2.2	Introduction
	2.3	Case Top and Shield
	2.6	Cable
	2.8	Analog Board
	2.10	Mechanical Assembly
	2.13	Door, Spring, and Bezel
Section 3 – Adjustments	3.2	DSPEED
Section 4 – Troubleshooting	4.2	Using the Troubleshooting Flowchart
	4.3	Troubleshooting Flowchart
Section 5 – Preventive Maintenance	5.2	Introduction
	5.2	Read/Write Head
	5.3	Head Load Button
	5.4	Motor Drive Belt
Section 6 – Illustrated Parts List	6.3	Finished Goods Assembly (Figure 1)

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Apple Technical Procedures

Apple 5.25 Drive / UniDisk

Section 1 – Basics

❑ CONTENTS

1.2 Product Description
1.2 Model Comparison
1.2 Connecting the Drives

❑ PRODUCT DESCRIPTION

Model Comparison

The Apple® 5.25 Drive and the UniDisk™ are floppy-disk drives that use removable single-sided disks to store and retrieve up to 143K of data per disk. The Apple 5.25 Drive and the UniDisk are compatible with any computer in the Apple II family.

The Apple 5.25 drive, in the new platinum case color, contains the same drive mechanism as the UniDisk, but has the added feature of a security lock connector. All technical procedures for the Apple 5.25 Drive and the UniDisk are the same.

Connecting the Drives

The 5.25 Drive and the UniDisk may be connected to a disk drive port (on an Apple IIGS™ or IIc) or to a 5.25 Drive controller card installed in a peripheral slot (in an Apple IIe or IIGS). (The 5.25 Drive controller card is identical to the UniDisk or DuoDisk® controller card.)

1. The controller card supports a maximum of two 5.25 drives. To add more drives, you must install a second 5.25 Drive controller card. You cannot plug a 3.5 drive into a 5.25 controller card, nor a 5.25 drive into a 3.5 controller card.

2. The disk drive port on the Apple IIGS will support a combination of up to four daisy chained 5.25 and 3.5 drives.

For installation instructions and daisy chain configurations, refer to the *Apple 5.25 Drive Owner's Guide.*

Apple Technical Procedures

Apple 5.25 Drive / UniDisk

Section 2 – Take-Apart

❑ CONTENTS

2.2 Introduction
2.3 Case Top and Shield
2.6 Cable
2.8 Analog Board
2.10 Mechanical Assembly
2.13 Door, Spring, and Bezel

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in this section.

❑ INTRODUCTION

Interchangeable Parts

The mechanical assemblies for the Apple 5.25 Drive, UniDisk, and DuoDisk are all the same and are therefore interchangeable—except for their sub-bezels and doors. **If you exchange mechanical assemblies, be sure to make the following sub-bezel and door replacements.**

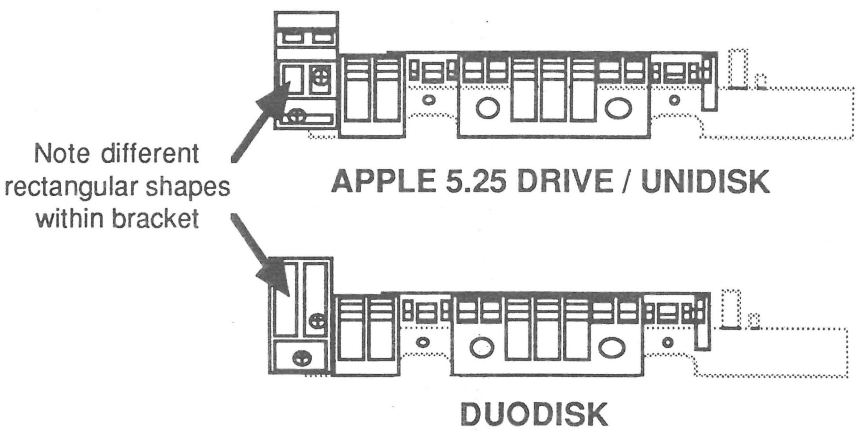
Apple 5.25 Drive/ and UniDisk

If you exchange the mechanical assemblies of an Apple 5.25 Drive and a UniDisk, **you must be sure to replace the sub-bezel and door so that the colors are appropriate.** The UniDisk has a beige door and beige sub-bezel. The Apple 5.25 Drive has a platinum door and beige sub-bezel.

DuoDisk

If you exchange a DuoDisk mechanical assembly with an Apple 5.25 Drive or a UniDisk, you must exchange the sub-bezels. The figure below shows the different sub-bezels.

The procedures for replacement are given in "Door, Spring, and Bezel" later in this Take-Apart section.



❑ CASE TOP AND SHIELD

Materials Required

Medium Phillips screwdriver

Remove

To remove the case top and shield:

1. If the Apple 5.25 Drive or UniDisk is connected to a computer, power off the computer and disconnect the drive. (You will not be able to remove the cable until you remove the cover.)

2. Turn the drive upside down and remove the four Phillips screws (Figure 1, #1).

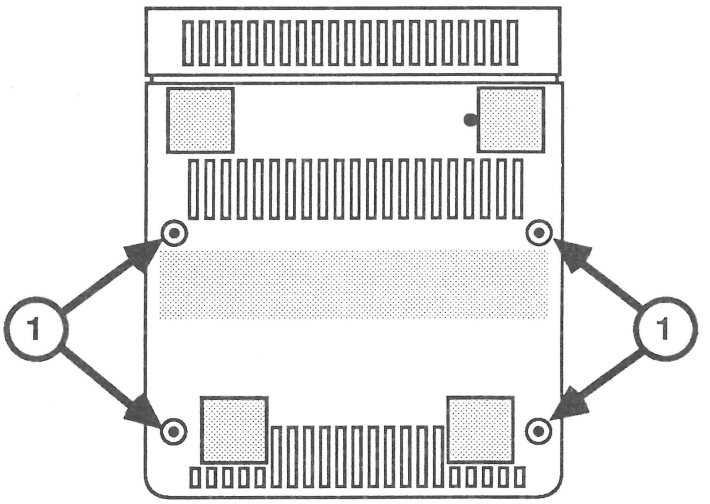


FIGURE 1

4. Orient the drive so that the back is facing you and remove the two Phillips screws (Figure 2, #1).

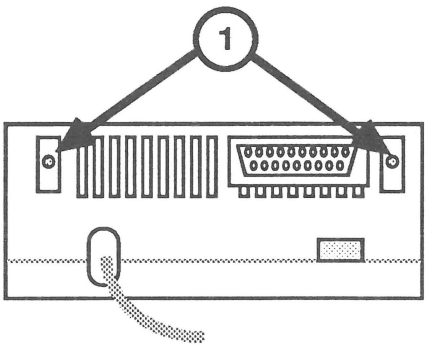


FIGURE 2

5. Pull up on the back of the case top until it clears the cable as shown in Figure 3. Slide the case top back and away from the drive.

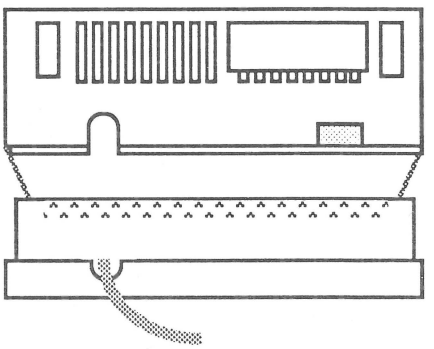


FIGURE 3

6. Remove the screw that secures the shield (top metal plate) to the chassis.

7. Pull up on the back edge of the shield and lift it off.

Replace

To replace the shield and case top:

1. Replace the shield by fitting the front prongs into place, then lowering the back until the shield is flush with the chassis.

2. Replace the Phillips screw to secure the shield to the chassis.

3. Fit the cable brace into the cutout at the back of the case bottom.

4. Slide the front edge of the case top against the front bezel as shown in Figure 4.

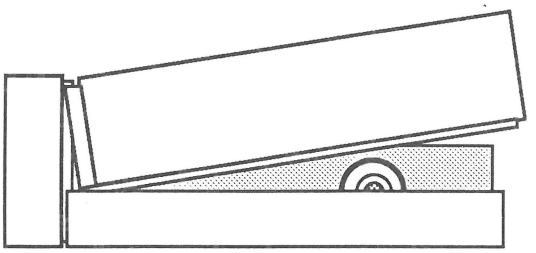


FIGURE 4

5. Push forward on the case top as you lower it over the cable, until the case top is flush against the case bottom.

6. Turn the drive upside down and replace the four Phillips screws.

7. Position the drive so that the back is facing you and replace the two Phillips screws.

❑ CABLE

Materials Required

Medium Phillips screwdriver

Remove

To remove the cable:

1. Remove the case top and shield.

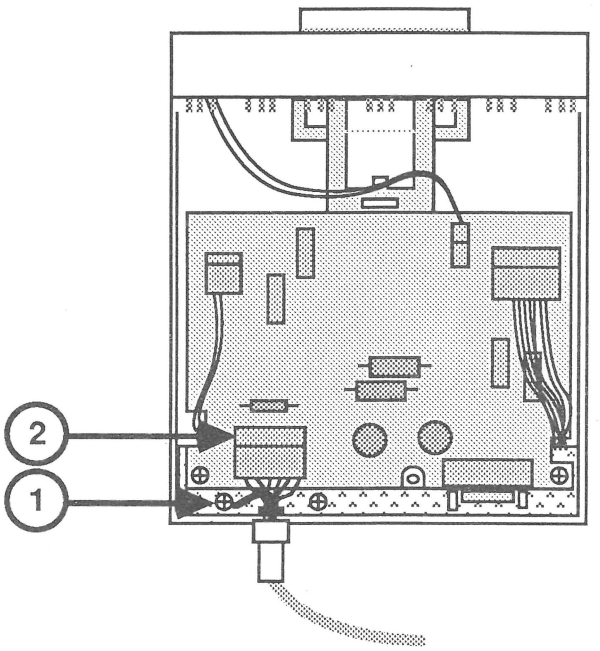


FIGURE 5

2. Remove the Phillips screw (Figure 5, #1) that secures the cable ground terminal and the case ground strap to the chassis.

3. Disconnect the bus connector from header J2 on the analog board (Figure 5, #2), and pull it back through the hole in the metal backplate.

4. Remove the cable.

Replace

To replace the cable:

1. Fit the cable brace (Figure 6, #1) into the slot at the back of the case bottom.

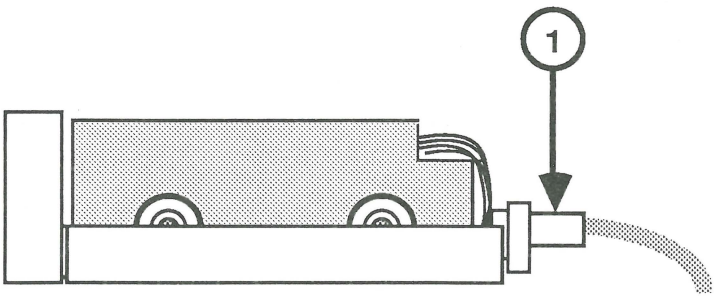


FIGURE 6

2. Replace the Phillips screw to secure the cable ground terminal and the ground strap to the chassis (Figure 5, #1).

3. Push the bus connector back through the hole in the metal backplate and reconnect it to header J2 on the analog board (Figure 5, #2).

4. Replace the shield and case top.

❑ ANALOG BOARD

Remove

To remove the analog board:

1. Remove the case top and shield.

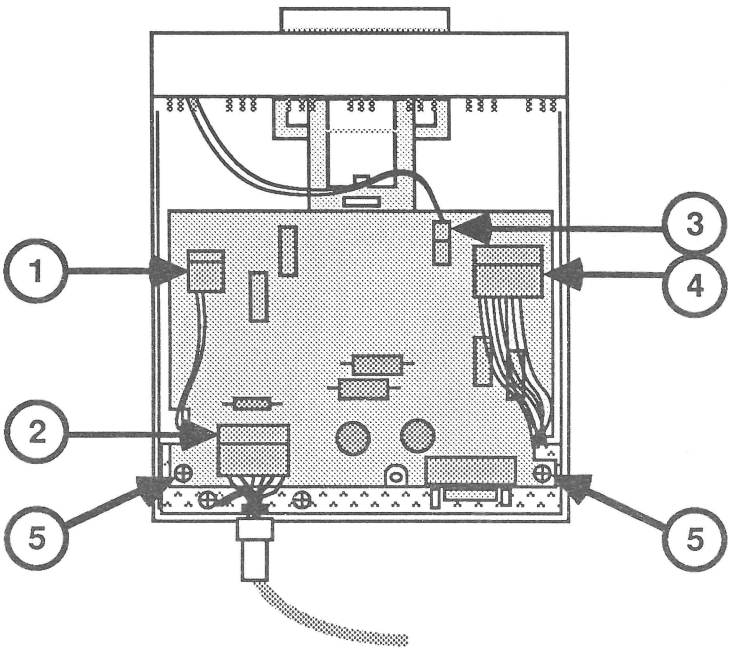


FIGURE 7

2. Disconnect the following connectors, pulling on the connector housing (not the wires):

   - Head connector J4 (Figure 7, #1)
   - Bus connector J2 (Figure 7, #2)

     Note: Pull the bus connector back through the metal backplate on the analog board.

   - LED connector J5 (Figure 7, #3)
   - Stepper motor connector J1 (Figure 7, #4) - note position of wires in Figure 7.

3. Remove the two Phillips screws (Figure 7, #5) that secure the analog board to the chassis.

4. Carefully lift the analog board off of the chassis.

Replace

To replace the analog board:

1. Lift the connector wires away from the mechanical assembly.

2. Slide the front end (opposite the DB-19 connector) of the analog board between the supports at front of the chassis walls.

***CAUTION:** Be careful not to pinch the connector wires while positioning the analog board.*

---

3. Route the connector wires through the cutouts at the sides of the analog board.

4. Connect the following connectors:

   - Head connector J4 (Figure 7, #1) - fits only one way

   - Bus connector J2 (Figure 7, #2)

     Note: First route the bus connector through the metal backplate on the analog board.

   - LED connector J5 (Figure 7, #3)

   - Stepper motor connector J1 (Figure 7, #4) - note position of wires in Figure 7

5. Replace the two Phillips screws (Figure 7, #5) to secure the analog board to the chassis.

6. Replace the shield and case top.

❑ MECHANICAL ASSEMBLY

Remove

To remove the mechanical assembly:

1. Remove the case top and shield, the cable, and the analog board..

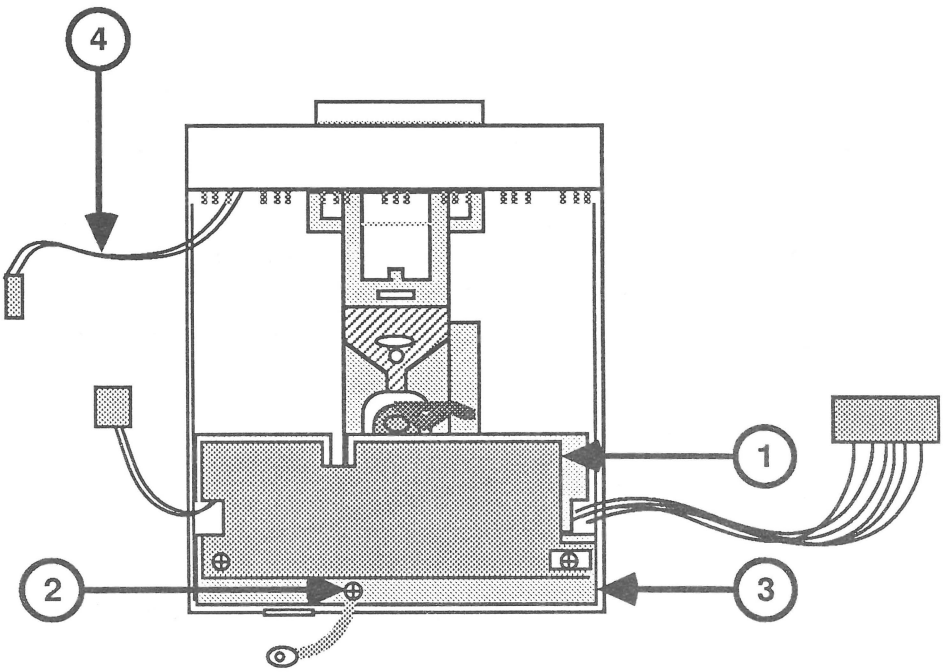


FIGURE 8

2. Remove the black insulation paper (Figure 8, #1).

3. Remove the Phillips screw (Figure 8, #2) that secures the ground strap to the chassis. Set the ground strap aside.

4. Lift off the metal shield (Figure 8, #3) and set aside.

5. Grasp the LED wires (Figure 8, #4) as close to the front bezel as possible and pull the LED lamp out of the front bezel.

6. Lift up on the back of the metal chassis and slide it completely out of the case bottom.

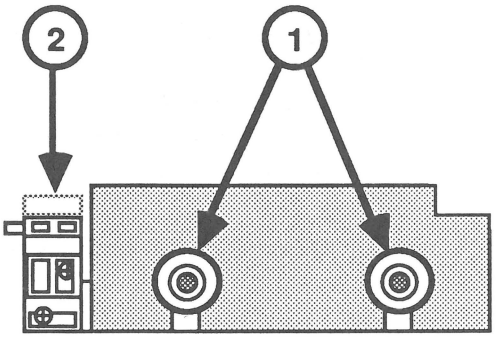


FIGURE 9

7. Orient the drive sideways, as shown in Figure 9, and remove the two Phillips screws (Figure 9, #1). Then turn the drive so that you face the other side, and remove those two screws.

8. Lift up on the sub-bezel (Figure 9, #2) and carefully slide the mechanical assembly out of its bottom shield.

Replace

To replace the mechanical assembly:

IMPORTANT: *Be sure to read the introduction to this section prior to exchanging the mechanical assembly.*

1. Place the mechanical assembly back inside its bottom shield.

2. Replace the Phillips screws (Figure 9, #1) on both sides of the drive to secure the mechanical assembly inside the bottom shield.

3. Replace the metal shield (Figure 8, #3), routing the cables through the cutouts at the sides of the shield. (See Figure 8.)

4. Place the black insulation paper (Figure 8, #1) on the metal shield as shown in Figure 8.

5. Replace the Phillips screw (Figure 8, #2) to secure one end of the ground strap to the chassis.

6. Locate the case bottom and insert the LED into the cutout provided at the front.

7. Close the door of the mechanical assembly.

8. Hold the LED cable out of the way while you carefully slide the mechanical assembly into the case bottom.

9. Replace the analog board, cable, shield, and case top.

❑ DOOR, SPRING, AND BEZEL

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the mechanical assembly.
2. Remove the two Phillips screws at each side of the sub-bezel, and remove the sub-bezel.
3. Slide the door off the mechanical assembly.

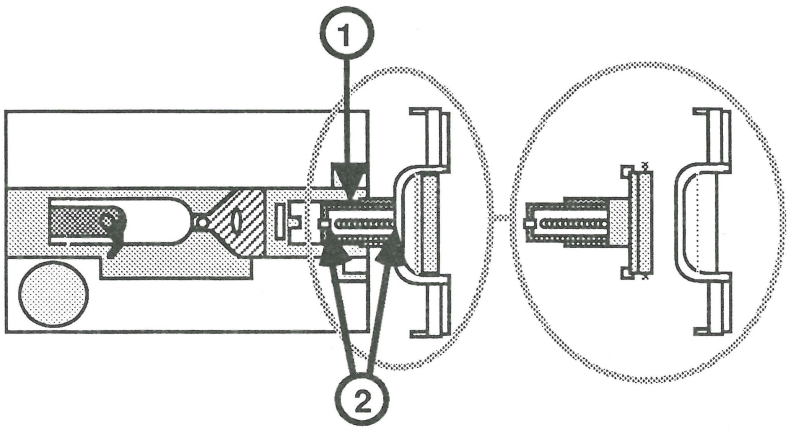


FIGURE 10

Replace

1. Install the new door, making sure the side edges of the door fit into the grooves on the metal carriage (Figure 10, #1) and the door springs fit over the supporting tabs (Figure 10, #2).
2. Reattach the sub-bezel.

   Note: A defective mechanical assembly must be returned to Apple with a sub-bezel attached.

3. Replace the mechanical assembly.

Apple Technical Procedures

Apple 5.25 Drive / UniDisk

Section 3 – Adjustments

❑ CONTENTS

3.2 DSPEED

Note: If a step is underlined, detailed instructions for that step can be found in Section 1, Take-Apart.

❑ DSPEED

This adjustment procedure was written to be used with the *5.25 Floppy Drive Test Assembly*—if the test indicates that you need to adjust the drive speed. All information on setting up and running the diagnostic is in the *Multi-Product Diagnostics Technical Procedures*, Section 2, 5.25-Inch Floppy Drive Test.

Materials Required

Multi-Product Diagnostics Technical Procedures manual
A small (jeweler's) flat-blade screwdriver
Apple II, II Plus, IIe, IIc, or IIGS
Known-good disk drive and controller (the controller is not necessary for the IIc and IIGS)
Apple 5.25 Drive or UniDisk to be adjusted

Making the Adjustment

To adjust the DSPEED (drive speed):

1. Remove the disk drive case.

2. Start the Drive Speed test (see the *Multi-Product Diagnostics Technical Procedures*, Section 2, 5.25-Inch Floppy Drive Test).

3. Locate the DSPEED adjustment hole under the drive being adjusted. It is a small hole next to the rubber foot on your right (when facing the drive) and nearest the front of the drive. The adjustment screw is located inside the hole.

   Note: When you make the DSPEED adjustment, keep the Apple 5.25 Drive or UniDisk flat.

4. The adjustment is extremely sensitive, so turn the adjustment screw very slowly. The indicator on the screen will move back and forth to show changes in speed.

5. Adjust the speed so that the indicator stays within the "good" range—as close to 0 as possible. Let the test run for 30 seconds.

6. Press <Escape> to return to the main menu; then repeat the test.

   Does the DSPEED now stay within the "good" range?

   - Yes—Press <Escape> to return to the main menu.

   - No—If the DSPEED cannot be properly adjusted, return the faulty drive mechanism to Apple.

Apple Technical Procedures

Apple 5.25 Drive / UniDisk

Section 4 – Troubleshooting

❑ CONTENTS

4.2 Using the Troubleshooting Flowchart
4.3 Troubleshooting Flowchart

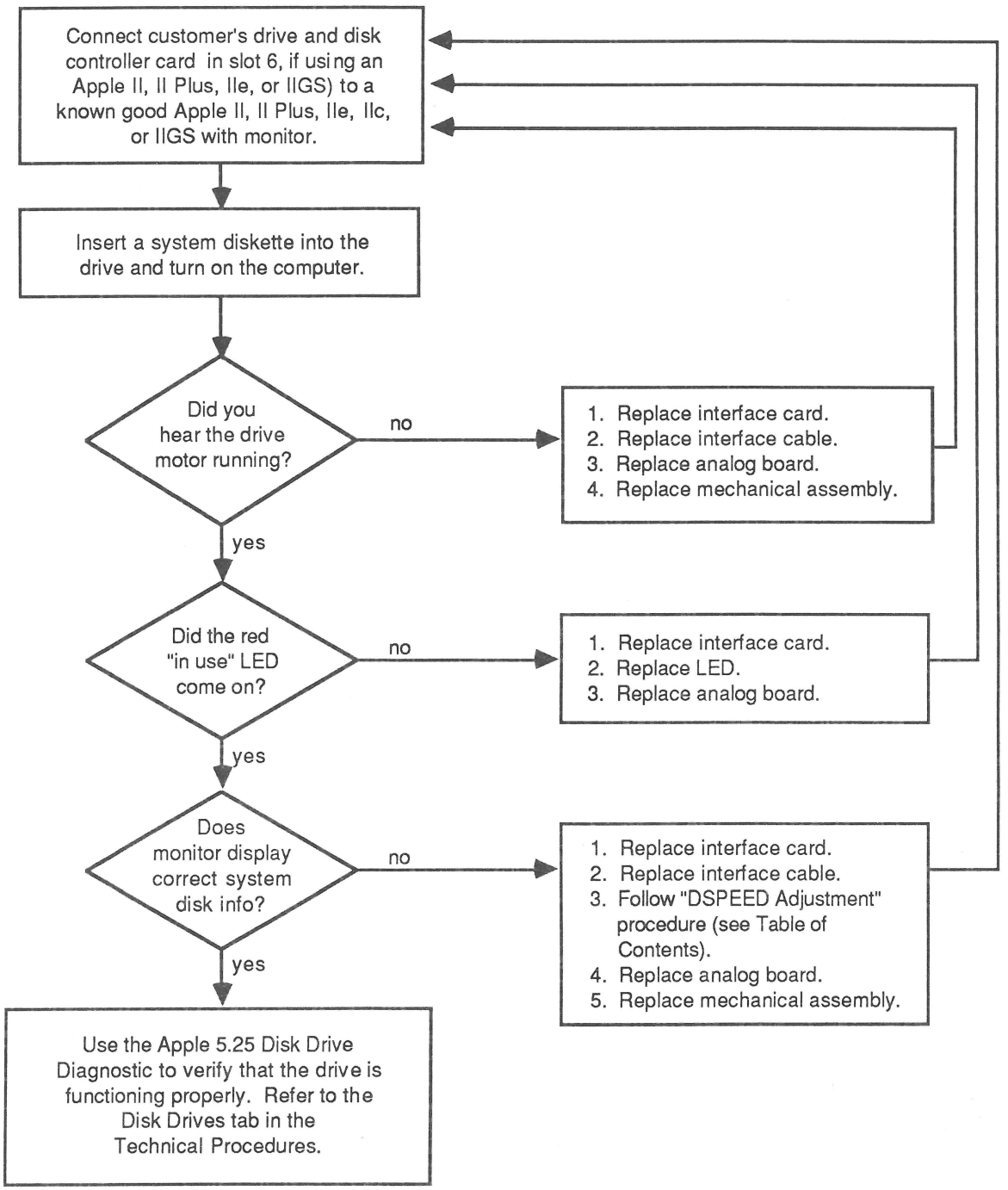
❑ USING THE TROUBLESHOOTING FLOWCHART

Whenever a customer brings in a presumably bad Apple 5.25 Drive or UniDisk, use the flowchart on the following page as a troubleshooting guide. Begin with the box in the upper left corner of the page. When you get to one of the answer boxes, swap the modules, one at a time, in the order in which they are listed. Each time you swap out a module, go back to the beginning of the flowchart. Turn on the computer and see if you can boot a system diskette (preferably a ProDOS *System Utilities* diskette.)

Once you are able to boot the *System Utilities*, be sure to run the latest Apple drive diagnostic, performing any adjustments necessary. Reinstall the customer's modules, one at a time, running the drive diagnostic after each exchange to isolate the bad modules.

Note: If you do not know how to connect the Apple 5.25 Drive or UniDisk to an Apple computer, refer to the *Apple 5.25 Drive Owner's Guide* for instructions.

UNIDISK / APPLE 5.25 DRIVE TROUBLESHOOTING FLOWCHART



Apple Technical Procedures

Apple 5.25 Drive / UniDisk

Section 5 – Preventive Maintenance

❑ CONTENTS

5.2 Introduction
5.2 Read/Write Head
5.3 Head Load Button
5.4 Motor Drive Belt

Note: If a step is underlined, detailed instructions for that step can be found in Section 2, Take-Apart.

❑ INTRODUCTION

The read/write head should be cleaned any time the computer or disk drive is being serviced. The head load button should be replaced whenever it is worn or dirty. The motor drive belt should be inspected any time the disk drive is being serviced.

❑ READ/WRITE HEAD

Materials Required

#2 Phillips screwdriver
Cotton swabs
Isopropyl Alcohol (80% alcohol/20% water)

Procedure

To service the read/write head:

1. Remove the top cover, drive shield, and analog board.
2. Clean the guide rails with the isopropyl alcohol. **Do not** use grease.
3. Inspect the head for worn or dull spots in the ceramic. If you find any, replace the mechanical assembly.
4. Clean the head with the isopropyl alcohol.
5. Move the read/write head assembly back and forth along the full length of its travel. Check for any blockage or friction. If there is any, replace the mechanical assembly.
6. Replace the analog board, drive shield, and top cover.

❑ HEAD LOAD BUTTON

Materials Required

#2 Phillips screwdriver
Needlenose pliers
Head load button

Procedure

To service the head load button:

1. Remove the top cover, drive shield, and analog board.

2. Lift up the head load arm. If the head load button is worn or dirty, squeeze the top part of the load button with small needlenose pliers and let the button drop down.

3. Insert the new load button into the head load arm. Press the button until it snaps into place.

5. Replace the analog board, drive shield, and top cover.

❑ MOTOR DRIVE BELT

Materials Required

#2 Phillips screwdriver
Motor drive belt

Procedure

To service the motor drive belt:

1. Remove the case, and the top and bottom shield.
2. Turn the drive upside down and locate the belt. Check the belt for cracks, slippage, and elasticity. If the belt is dry or cracked, or if it slips, continue with step 3.
3. Slip the belt off the pulley.
4. Place the new belt around the motor spindle and then slip it around the pulley.
5. Replace the top and bottom shield, and the case.

Apple Technical Procedures

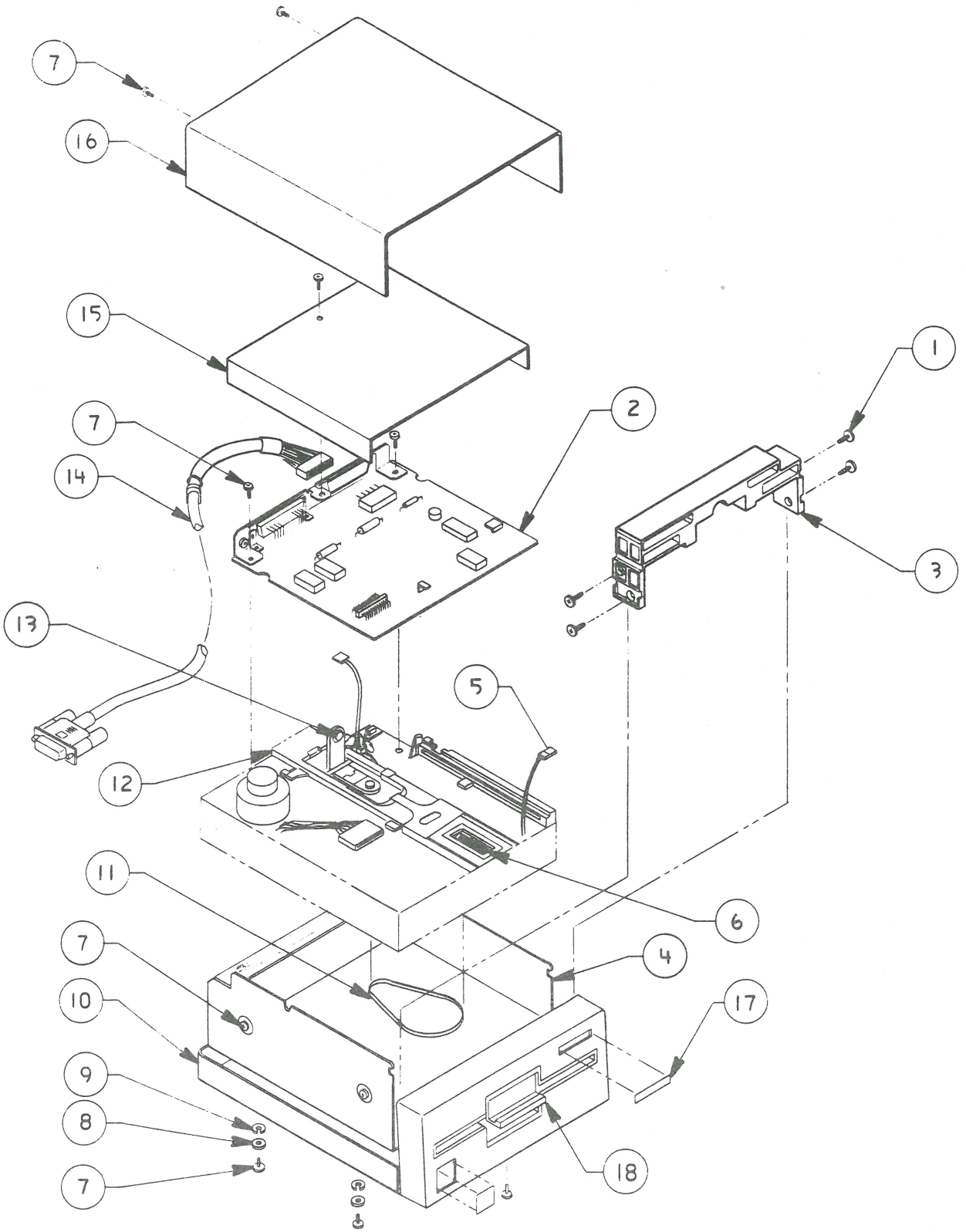
Apple 5.25 Drive / UniDisk

Section 6 – Illustrated Parts List

❑ CONTENTS

6.3 Finished Goods Assembly (Figure 1)

The figure and list in this section include all piece parts that can be purchased separately from Apple for the Apple 5.25 Drive and UniDisk, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs Manual* for prices.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❑ 5.25 DRIVE/UNIDISK—FINISHED GOODS ASSEMBLY (Figure 1)

Item	Part No.	Description
1	400-3604	Screw, 6-32 x 1/4, Pozi-Dr. Flt.
2	661-0287	Analog Card, UniDisk
3	970-1258	Sub-Bezel, Universal Uni/Apple 5.25
4	805-0890	Bottom Shield
5	590-0140	LED Cable Assembly, D1
6	870-0023	Spring
7	400-1604	Screw, 6-32 x 1/4
8	860-0242	Washer, M3.5 x 4.0 I.D. x 7.0 O.D.
9	860-0053	Washer, Split Lock Metric, 3.5 mm
10	675-5101	Bottom Cover, Beige
	603-5111	Bottom Cover, Platinum
11	U880-0002	Disk Drive Belt
12	661-72128	Uni/DuoDisk Disk Mechanical Assembly
13	U815-0064	Load Button
14	590-0327	Cable, Drive-to-CPU, Beige
	590-0367	Cable, Drive-to-CPU, Smoke
15	805-0891	Top Shield
16	675-5103	Top Cover, Beige
	603-5112	Top Cover, Platinum
17	825-0548	Label, Drive #, Uni/DuoDisk
18	603-5113	Door, Smoke
	815-0637	Door, Beige

Apple Technical Procedures

Monitor II / Monochrome Monitor IIe

Technical Procedures

❑ TABLE OF CONTENTS

Section 1 – Basics	1.2	Product Description
	1.3	Setup Procedure
Section 2 – Take-Apart	2.2	Back Case
	2.4	Discharging the Cathode-Ray Tube (CRT)
	2.4	Discharge Procedure
	2.5	Anode Cap
	2.6	Line Filter Board
	2.12	Main Electronics Assembly
	2.18	Cathode-Ray Tube (CRT)
	2.22	Fuse
	2.25	Power Switch
	2.26	Power Transformer
Section 3 – Adjustments	3.3	General Information
	3.4	Yoke Adjustments
	3.6	Set-Up Procedure
	3.8	Tilt Adjustment
	3.10	Ring Adjustment
	3.11	Geometric Adjustments
	3.14	Main Electronics Assembly Adjustments
	3.15	Setup Procedure
	3.16	Vertical Adjustments
	3.18	Horizontal Adjustments
Section 4 – Troubleshooting	4.3	Introduction
	4.3	Symptom Chart

Section 5 – Additional Procedures

5.2 Power Cord Upgrade Procedure
5.4 Line Filter Board Modification
5.4 Resistance Check

Illustrated Parts List

IPL.3 Monitor II/Monochrome Monitor IIe

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Apple Technical Procedures

Monitor II/Monochrome Monitor IIe

Special Notice

The platinum version of the Monitor II is called the Apple Monochrome Monitor IIe. Except for the name and the color, the monitors are identical and all procedures are the same for both.

Apple Technical Procedures

Monitor II / Monochrome Monitor IIe

Section 1 – Basics

❑ CONTENTS

1.2 Product Description
1.3 Setup Procedure

WARNING: *Some older Monitor IIs have the fuse connected to the neutral side of input power. This condition should be corrected. Refer to the "Power Cord Upgrade Procedure" in Section 5, Additional Procedures, to identify and correct this condition.*

❑ PRODUCT DESCRIPTION

The Apple® Monitor II/Monochrome Monitor IIe is a 12-inch CRT display monitor that is used with Apple II or IIe computers. The monitor has a built-in handle for easy carrying. The screen tilts up or down to help reduce screen glare. When the power is on, the power switch (located at the upper-right corner) remains depressed and the green LED is lit.

The contrast control, at the right front, is the only adjustment knob on the front of the monitor. Other user-accessible controls are on the back. They are:

- Brightness
- Vertical hold
- Vertical size, which lengthens or shortens the vertical height of the picture

The internal controls, used for service adjustments, are:

- Horizontal width
- Horizontal linearity, which assures that the characters are of uniform width on both sides of the screen
- Horizontal hold, which controls horizontal rolling or tearing on the screen
- Vertical linearity, which assures that the top and bottom characters are the same size
- Focus, which is used to maintain the best overall image on the screen

The Apple Monitor II/Monochrome Monitor IIe contains a cathode-ray tube (CRT), which operates at very high voltages and contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself), scattering glass in all directions.

WARNING: Before working inside this monitor, read Section 8, CRT Safety, under the* You Oughta Know *tab.

❑ SETUP PROCEDURE

Follow the steps below to set up the Apple Monitor II/ Monochrome Monitor IIe for use with the Apple II or IIe:

1. Connect one end of the video cable phono plug to the phono jack on the back of the monitor. Connect the other end to the computer's video output phono jack. (Both ends of the cable are the same.)

2. Plug the power cable into a three-hole grounded wall socket.

3. Start up a program that displays some text on the screen.

4. Turn the contrast control clockwise to its maximum. (The contrast control is located on the right-front edge of the monitor.)

5. Turn the brightness control clockwise until the fine lines that form the background of the display are clearly visible.

6. Turn the brightness control counterclockwise until the fine lines of the background are just extinguished.

7. Adjust the contrast control to give a pleasing level of text illumination.

8. Adjust the tilt of the screen so that it is perpendicular to your line of vision.

Apple Technical Procedures

Monitor II / Monochrome Monitor IIe

Section 2 – Take-Apart

❑ CONTENTS

2.2 Back Case
2.4 Discharging the Cathode-Ray Tube (CRT)
2.4 Discharge Procedure
2.5 Anode Cap
2.6 Line Filter Board
2.12 Main Electronics Assembly
2.18 Cathode-Ray Tube (CRT)
2.22 Fuse
2.25 Power Switch
2.26 Power Transformer

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in the section.

WARNING: *Due to a change in the line filter board design, some older versions of the Monitor II may not be properly grounded. As a result, some users may be exposed to electrical shock. Whenever you service a Monitor II, check the resistance of the grounding system to verify that the monitor is properly grounded. (Refer to "Line Filter Board Modification" in Section 5, Additional Procedures, for instructions in checking resistance and replacing a deleted ground.)*

WARNING: *In older versions of the Monitor II, the power cord conductor wires are not connected to the line filter board in the correct sequence. Whenever you open a Monitor II for repair, first check the power cord wiring to see if you need to replace the cord. (For identification of wiring and installation instructions, see "Power Cord Upgrade Procedure" in Section 5, Additional Procedures.)*

❑ BACK CASE

WARNING: *The Monitor II / Monochrome Monitor IIe contains high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the* You Oughta Know *tab before you remove the back cover.* ***Failure to follow the safety rules could result in serious injury.***

Materials Needed

Medium Phillips screwdriver (magnetic)

Remove

1. Disconnect the AC power cord from the wall outlet.
2. Place the monitor on its side and remove the five Phillips screws from the bottom of the case.
3. Set the monitor upright and remove the two screws from the handle recess.
4. Slide the back case away from the frame.
5. Pull the power cord through the opening in the back case. (If the plug is too large to fit through the opening in the back case, go on to step 6.)

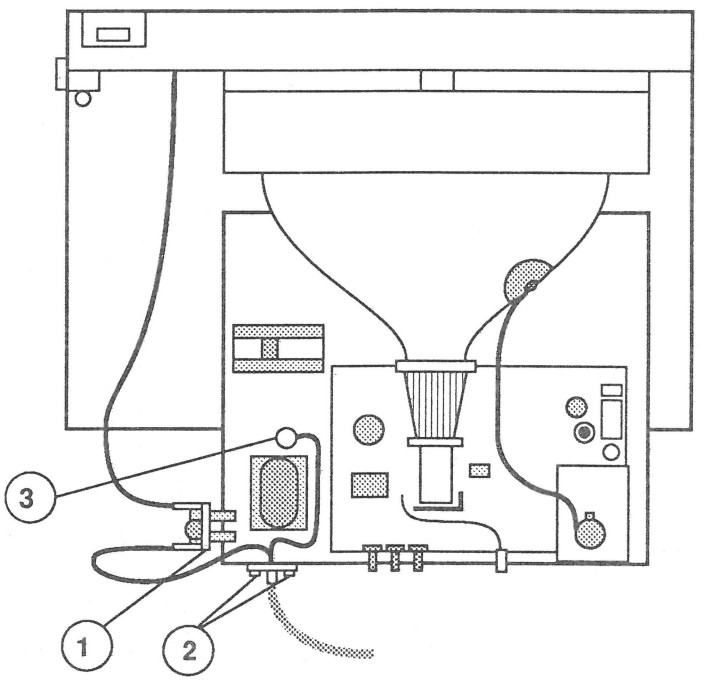


FIGURE 1

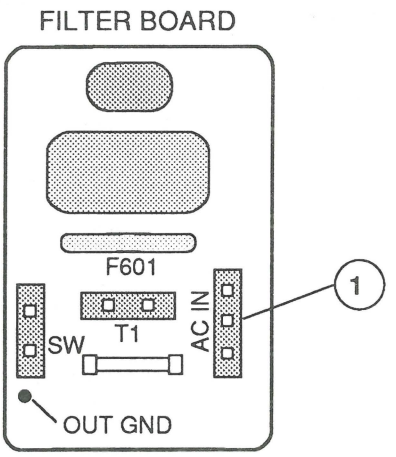


FIGURE 2

6. Discharge the CRT (see procedure next page).

7. The power cord does not have to be removed except in the following cases:

   - The monitor is an older version that does not have power cord wiring connected to the line filter board in the correct sequence (see "Power Cord Upgrade Procedure" in Section 5, Additional Procedures).

   - The monitor is an older version that does not allow the plug of the cord to fit through the opening in the back case—and you need to take the case completely off.

   - The power cord has failed.

   If you need to remove the cord, locate the line filter board (Figure 1, #1), disconnect the AC IN connector (Figure 2, #1) from the board, remove the two screws from the cord mounting plate (Figure 1, #2), remove any tie wraps, and (for platinum monitors only) remove the power cord's green ground wire from the chassis screw and nut (Figure 1, #3). Then withdraw the power cord wires through the hole in the chassis.

Replace

To reinstall the back case and power cord, follow the above procedure in reverse order. (If you are replacing the power cord, see the "Power Cord Upgrade Procedure" in Section 5, Additional Procedures.)

❑ DISCHARGING THE CATHODE-RAY TUBE (CRT)

Materials Required

Safety goggles
Foam pad (ungrounded)
Needlenose pliers
Alligator lead
New CRT discharge tool (part number **076-0381**)

WARNING: Before starting, read the safety precautions and the CRT discharge procedure in Section 8, CRT Safety, under the* You Oughta Know *tab. *Alternative instructions for discharging the CRT using the older version of the discharge tool (and/or a screwdriver) are given in that section.*

Discharge Procedure

1. **Remove your grounding wriststrap and jewelry and put on safety goggles before beginning!**

2. Remove the rear cover.

3. Set the monitor upright on the ungrounded foam pad, with the back facing you.

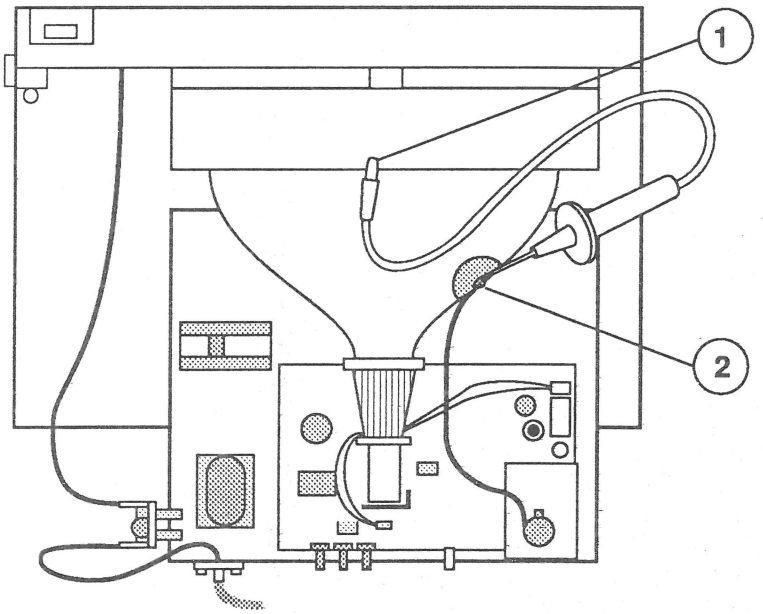


FIGURE 3

4. Attach the clip of the CRT discharge tool to any metal part of the chassis (Figure 3, #1).

5. Put one hand behind your back, and grasp the handle of the discharge tool with your other hand.

WARNING: *Use only one hand when discharging the CRT to prevent forming a path of current through your body should your hand slip and touch the metal part of the discharge tool during the discharge procedure.*

6. Hold the CRT discharge tool to the tube surface, and insert its probe under the anode cap (Figure 3, #2) until it touches the anode ring.

7. Remove the probe of the CRT discharge tool from under the anode cap and detach its clip from the metal chassis.

Note: If the bleeder resistor fails, a secondary charge could build up over time, even after you have discharged the CRT. To dissipate any residual charge, establish an ongoing ground by clipping one end of an alligator lead to the chassis frame and the other end to the anode ring or aperture.

Anode Cap

For some procedures, you may have to remove the anode cap. After you have discharged the CRT, peel back the anode cap until you can see the anode "ring" (or connector) at the center. Using needlenose pliers, compress the two prongs on the connector to free it from the anode aperture.

To replace the anode cap, press together the two prongs of the anode connector so that you can insert it into the aperture. Tug on the anode wire to make sure it is firmly seated, and then press down around the edges of the rubber anode cap to ensure a firm seal.

❑ LINE FILTER BOARD

WARNING: *Due to a change in the line filter board design, some older versions of the Monitor II may not be properly grounded. As a result, some users may be exposed to electrical shock. Whenever you service a Monitor II, check the resistance of the grounding system to verify that the monitor is properly grounded. (Refer to "Line Filter Board Modification" in Section 5, Additional Procedures, for instructions in checking resistance and replacing a deleted ground.)*

Materials Required

Medium Phillips screwdriver (magnetic)
Medium long-nose pliers
Small wire cutters
Soldering iron and solder

Remove

1. Remove the back case.
2. Discharge the CRT.

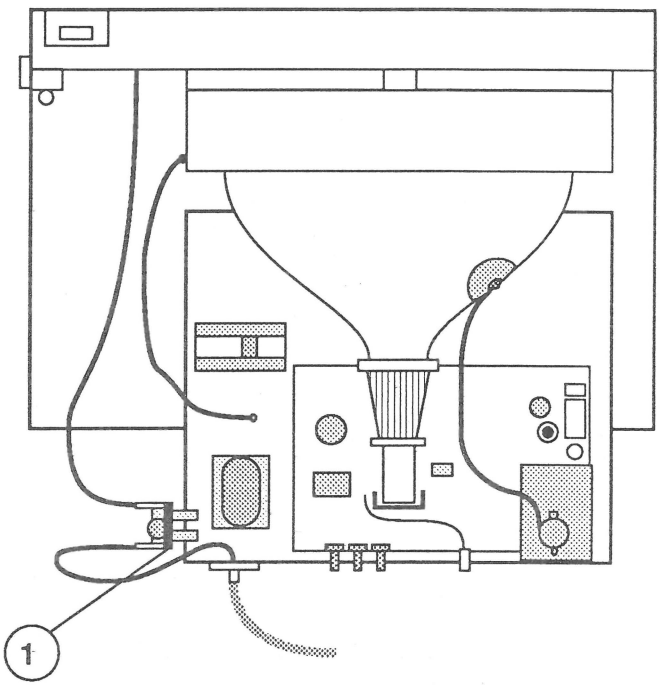


FIGURE 4

3. Locate the line filter board (Figure 4, #1).

4. Disconnect the following three connectors from the line filter board:

   - AC IN (Figure 5, #1)
   - T1 (Figure 5, #2)
   - SW (Figure 5, #3)

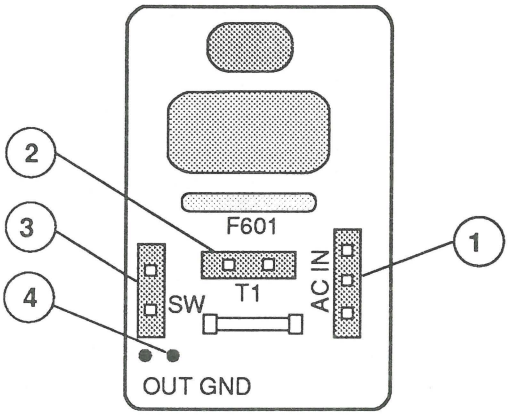


FIGURE 5

5. Remove the Phillips screw that holds the line filter board to the chassis. (Hold the hex nut on the back side of the screw with the long-nose pliers.)

6. Unsolder the green ground wire (Figure 5, #4) from the line filter board at the marking "OUT GND."

Replace

There are two versions of the Monitor II line filter board, and the replacement procedure is different for each version. Because of this, you must first identify which version of the filter board you are going to install.

Locate the AC IN connector pins on the line filter board (Figure 6, #1).

If there are only **two** AC IN connector pins at the markings **W** (white) and **B** (black) on the line filter board, the board is a new version with the ground pin deleted. For instructions on how to install the new line filter board, see "New Line Filter Board Installation."

If there are **three** AC IN connector pins at the markings **W** (white), **B** (black), and **G** (green) on the line filter board, the filter board is an old version. For instructions on how to install the old line filter board, see "Old Line Filter Board Installation."

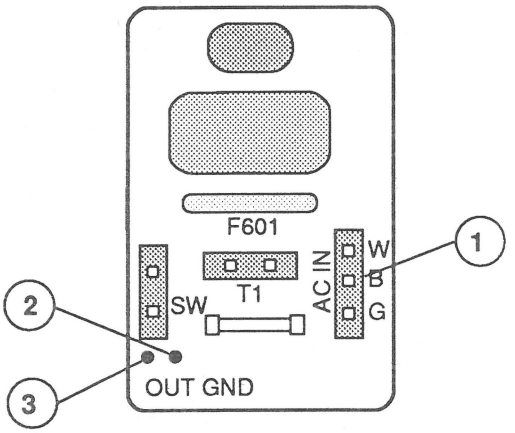


FIGURE 6

New Line Filter Board Installation

1. Locate the AC IN connector (Figure 7, #1) that you removed from the line filter board.

   If the AC IN connector has only **two** wires (white and black), the monitor power cord is a new version and the ground wire attaches directly to the monitor chassis. Proceed to step 2 of the procedure.

   If **three** wires (white, black, and green) are wired into the AC IN connector, the monitor power cord is an older version, and you **must** connect the power cord ground to the line filter board grounding circuitry as follows:

   a) Using small wire cutters, clip off the green AC IN ground wire close to the connector (Figure 7, #2).

   b) On the component side of the new filter board, locate the two solder points above the marking "OUT GND" (Figure 6, #2 and #3). Desolder to remove any solder present at either solder point.

   c) Solder the green AC IN ground wire to the solder point (Figure 6, #3) above the marking "OUT GND" on the filter board.

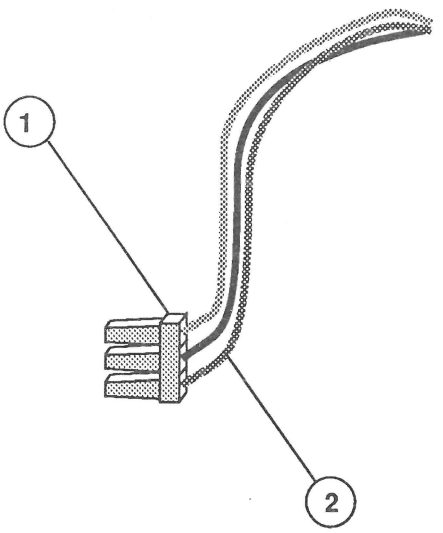


FIGURE 7

2. Locate the green ground wire that you desoldered from the customer's filter board, and solder the wire to the new filter board at the solder point (Figure 6, #2) above the marking "OUT GND."

3. Remount the line filter board to the chassis using the Phillips screw and hex nut.

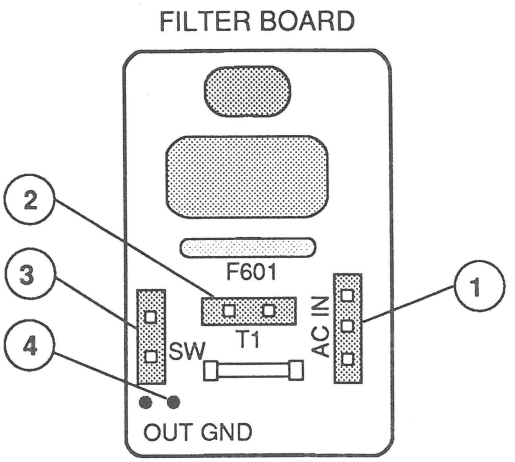


FIGURE 8

4. After reading the note below, plug in the three connectors to the line filter board:

   - AC IN (Figure 8, #1)
   - T1 (Figure 8, #2)
   - SW (Figure 8, #3)

   Note: Be careful with SW and T1—both are two-hole connectors and can be put on the wrong posts. T1 comes from the transformer and SW comes from the power switch. Be sure to orient T1 correctly: the board is marked B (black) and W (white) for this connector.

5. Replace the back case.

Old Line Filter Board Installation

1. Locate the green ground wire that you desoldered from the customer's filter board, and solder the wire to the replacement filter board at the solder point (Figure 7, #4) above the marking "OUT GND."

2. Remount the line filter board to the chassis using the Phillips screw and hex nut.

3. After reading the note below, plug in the three connectors to the line filter board:

   - AC IN (Figure 8, #1)
   - T1 (Figure 8, #2)
   - SW (Figure 8, #3)

   Note: Be careful with SW and T1—both are two-hole connectors and can be put on the wrong posts. T1 comes from the transformer and SW comes from the power switch. Be sure to orient T1 correctly: the board is marked B (black) and W (white) for this connector.

4. Replace the back case.

❑ MAIN ELECTRONICS ASSEMBLY

Materials Needed

Medium Phillips screwdriver (magnetic)
Medium long-nose pliers
Diagonal cutters
Exacto knife
Soldering iron and solder

Remove

1. Remove the back case.

2. Discharge the CRT.

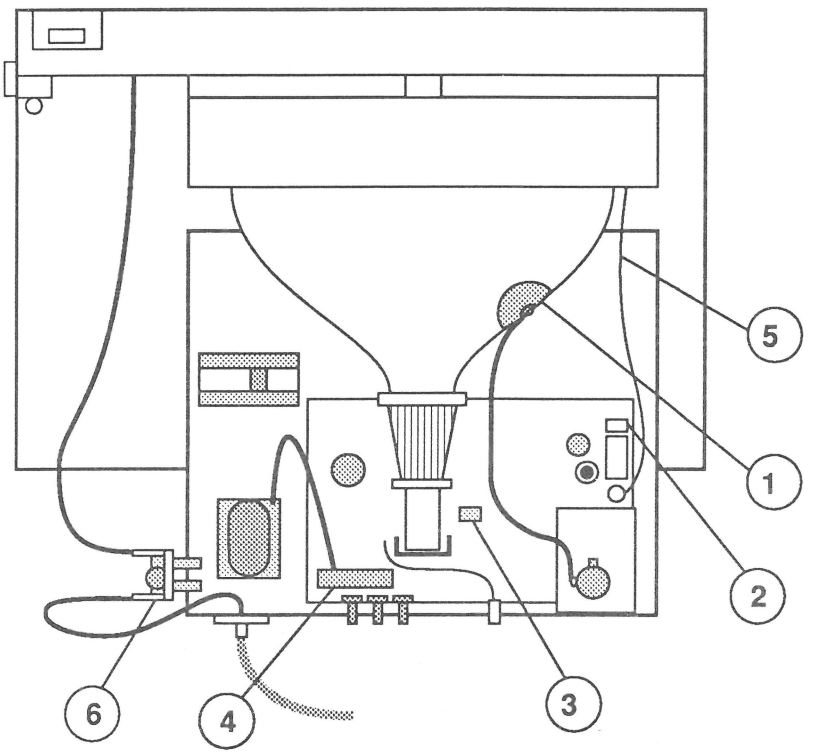


FIGURE 9

3. Remove the anode wire (Figure 9, #1) by peeling back the rubber cap, compressing the prongs of the anode connector clip (using long-nose pliers, if necessary), and pulling the connector out of the anode aperture.

4. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this until after the monitor has been discharged.)

5. Pull the chassis tray back as far as the wires will allow.

6. Disconnect the brown/gray wire from position H-DY (Figure 9, #2) and the green/white wire from position V-DY (Figure 9, #3) on the main electronics assembly. Using diagonal cutters, carefully cut all the tie wraps along these wires.

7. Disconnect the two red leads at location T2 near the left-rear edge of the main electronics assembly (Figure 9, #4).

8. To free the main electronics assembly ground wire (Figure 9, #5), remove the screw from the mounting tab at the upper-right corner of the CRT. (The antistatic shield finger plate, which is also held in place by this screw, will come off.)

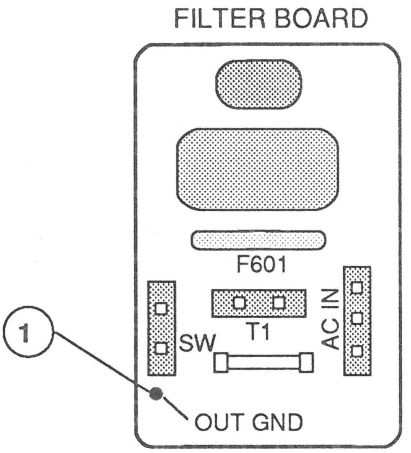


FIGURE 10

9. Locate the line filter board (Figure 9, #6). Unsolder the green ground wire from the line filter board at "OUT GND" (Figure 10, #1).

   Note: It may be easier to reach the solder on the back of the line filter board if you first remove the board from the chassis (see "Line Filter Board," earlier in this section).

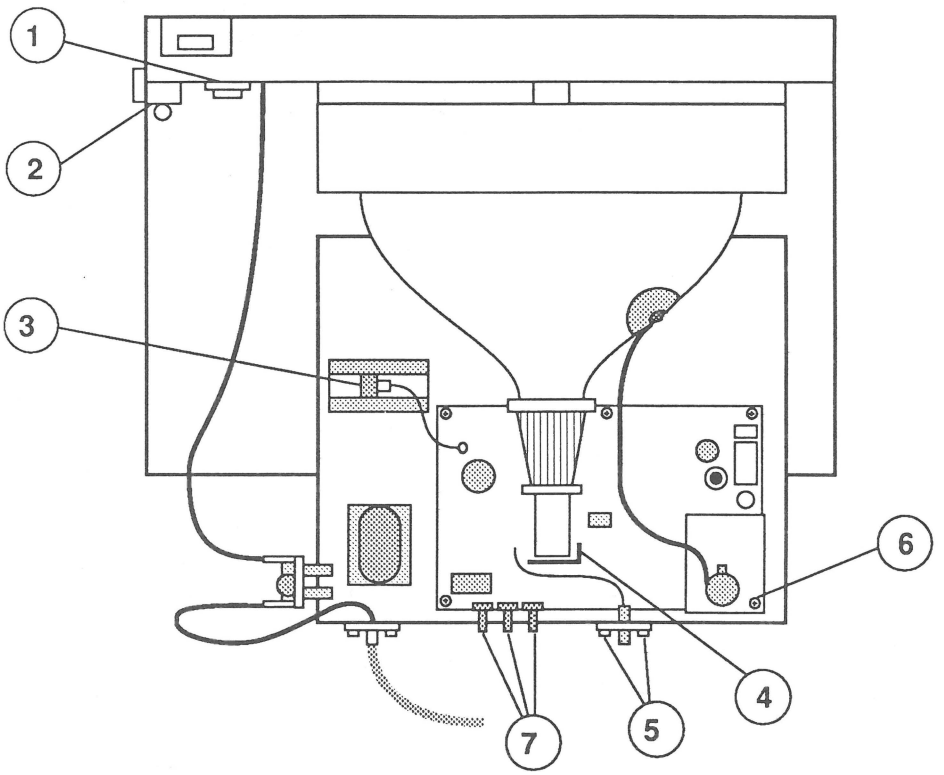


FIGURE 11

10. Remove the LED mounting screw (Figure 11, #1) and the two mounting screws that secure the contrast control (Figure 11, #2). The LED assembly and the contrast control assembly will remain attached to the main electronics assembly. Using diagonal cutters, carefully cut all tie wraps along these wires.

11. Disconnect the 3-wire connector (Figure 11, #3) from the transistor on the bottom of the metal chassis.

12. Disconnect the socket (Figure 11, #4) from the neck of the CRT.

13. Remove the two screws (Figure 11, #5) that attach the video jack to the chassis.

14. Remove the five mounting screws from the main electronics assembly.

15. The right-rear mounting screw (Figure 11, #6) also holds the flyback transformer shield. The connection between this corner of the main electronics assembly and the undermounting has been strengthened with glue. After removing the screw, remove the transformer shield, then loosen the glue by sliding an exacto knife between the main electronics board and the undermounting. Attempting to lift the board before the glue has been loosened will break the corner and make the main electronics assembly worthless.

16. The main electronics assembly can now be removed by sliding it forward to allow the rear control knobs (Figure 11, #7) to clear the chassis, and then lifting the board up and out.

Replace

1. Mount the main electronics assembly on the chassis, fitting the three rear control knobs (Figure 11, #7) through the holes in the chassis. Secure the board with the five mounting screws, making sure the flyback transformer shield also is secured with the right-rear mounting screw (Figure 11, #6).

2. Replace the two screws that secure the video jack (Figure 11, #5).

3. Replace the CRT socket (Figure 11, #4).

4. Connect the 3-wire connector to the transistor (Figure 11, #3) on the bottom of the chassis. Make sure the red wire is toward the back of the monitor. (A reversed connection results in a wavy screen and overheating of the regulator.)

5. Replace the screws that secure the LED assembly (Figure 11, #1) and the contrast control assembly (Figure 11, #2) to the inside of the bezel.

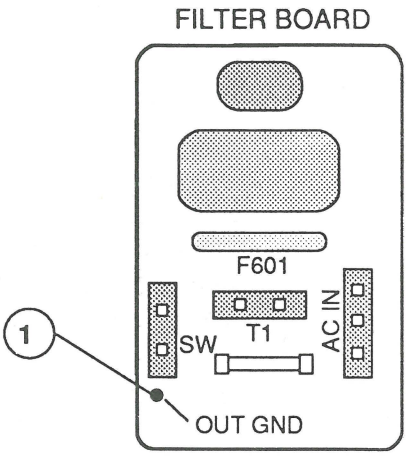


FIGURE 12

6. Locate the green ground wire (Figure 13, #6) from the main electronics assembly and solder it to the line filter board at the marking "OUT GND" (Figure 12, #1). (If you removed the line filter board from the chassis, remount it with its screw and reconnect any wires that you removed.)

7. Connect the two red leads from the transformer to connector T2 (Figure 13, #1) on the main electronics assembly.

8. Connect the brown/gray wire to the H-DY connector (Figure 13, #2) and the green/white wire to the V-DY connector (Figure 13, #3) on the main electronics assembly.

9. Replace the mounting screw that secures the main electronics assembly ground wire (Figure 13, #4) to the upper-right corner of the CRT. (Be sure to replace the antistatic shield finger plate, which is also held in place by this screw.)

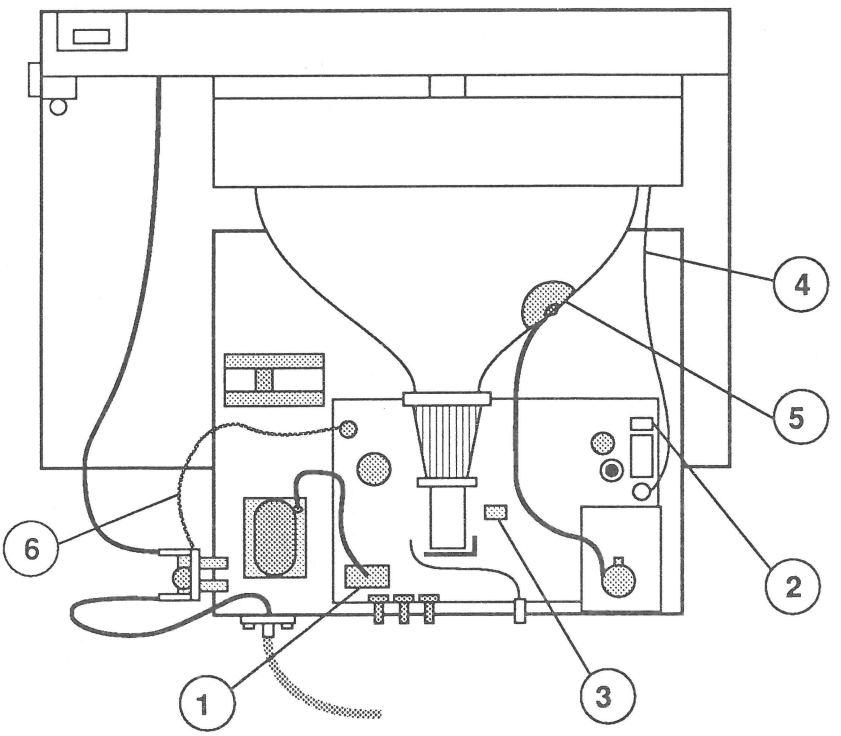


FIGURE 13

10. Tiewrap the wires that are in groups, making sure that the chassis tray can slide all the way in and out without binding.

11. Reconnect the anode cap to the anode of the CRT (Figure 13, #5), making sure that both metal clips are settled in securely.

IMPORTANT: *When a new main electronics assembly is installed, the horizontal or vertical circuits may need adjustment (see "Main Electronics Assembly Adjustments" in Section 3, Adjustments).*

12. Replace the back case.

❑ CATHODE-RAY TUBE (CRT)

Materials Needed

Medium Phillips screwdriver (magnetic)
Medium long-nose pliers
Exacto knife

Remove

1. Remove the back case.

2. Discharge the CRT.

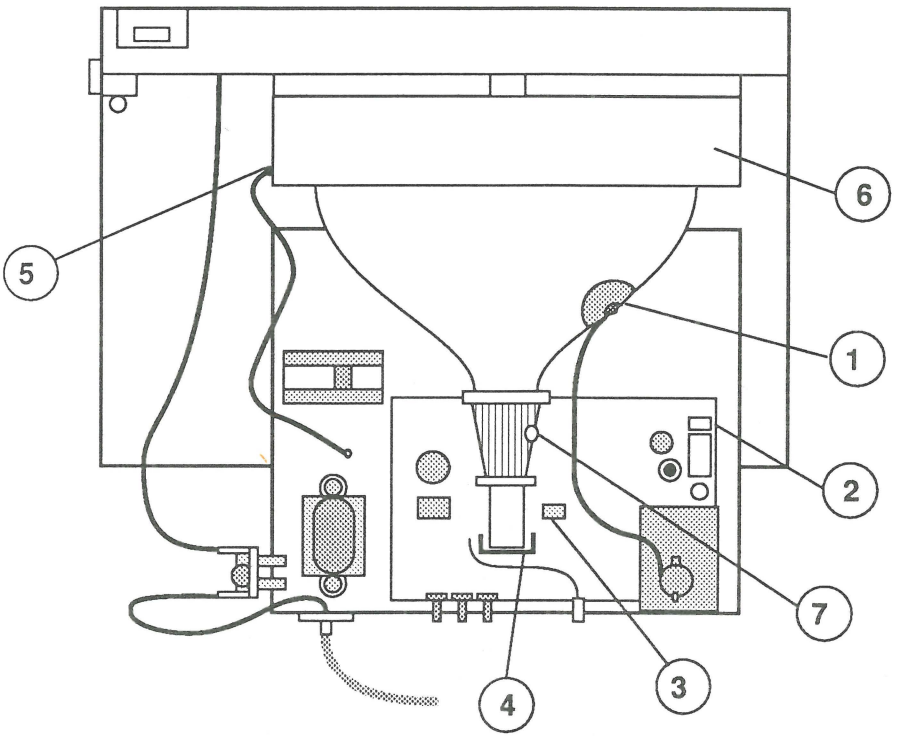


FIGURE 14

3. Remove the anode wire (Figure 14, #1) by peeling back the rubber cap, compressing the prongs of the anode connector clip (using long-nose pliers, if necessary), and pulling the connector out of the anode aperture.

4. Place the discharged monitor on a grounded workbench pad and put on your grounding wriststrap. (Never put on the wriststrap until after the monitor is discharged.)

5. Pull the chassis tray back as far as the wires will allow.

6. Disconnect the brown/gray wire from position H-DY (Figure 14, #2) and the green/white wire from position V-DY (Figure 14, #3) on the main electronics assembly. Using diagonal cutters, carefully cut all the tie-wraps along these wires.

7. Disconnect the socket (Figure 14, #4) from the neck of the CRT.

8. Remove the screw (Figure 14, #5) that secures the chassis ground wire to the left side of the top ground shield.

9. Remove the five screws that hold the upper shield (Figure 14, #6) to the front bezel, and remove the shield.

10. Remove the two bottom CRT mounting screws (one at each lower corner).

11. Supporting the CRT with one hand, remove the two top CRT mounting screws. The antistatic shield finger plate on the top-right will come off.

12. When all four mounting screws have been removed, gently lift out the CRT. (If the CRT is hard to remove, support the bottom of the CRT with one hand and gently push on the front of the tube with the other hand.)

13. If you need to remove the yoke assembly from the CRT, loosen the clamp screw (Figure 14, #7) and slide the yoke off to the rear of the CRT. (If necessary, cut through the adhesive at the front of the yoke with a scalpel knife.)

WARNING: *If you intend to dispose of the CRT, refer to "Disposing of the Cathode-Ray Tube" in Section 8, CRT Safety, under the* You Oughta Know *tab.*

Replace

1. Place the front bezel face down and insert the CRT into the bezel with the anode aperture oriented toward your right, aligning the four corner mounting tabs with the bezel screw holes.

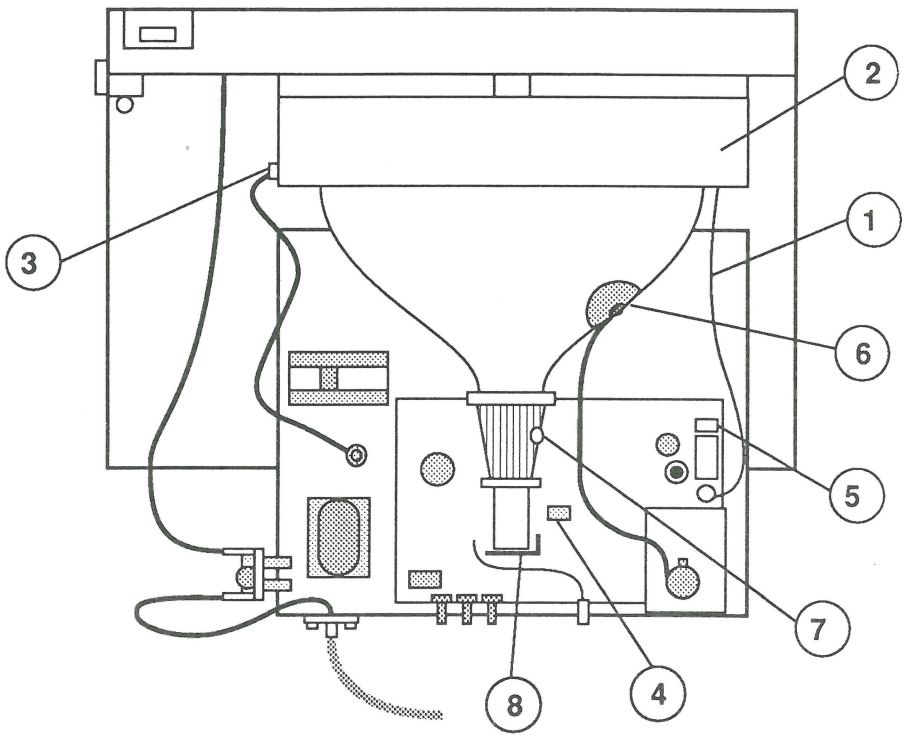


FIGURE 15

2. Replace the top-left mounting screw first, then the top-right screw, making sure that the antistatic shield finger plate is in place (it should touch the CRT) and that the black ground wire (Figure 15, #1) from the right side of the main electronics assembly is also attached to the same screw. Then replace the two bottom mounting screws.

3. Slide in the chassis tray.

4. Reinstall the top ground shield (Figure 15, #2) with its five mounting screws.

5. Replace the screw (Figure 15, #3) that secures the chassis ground wire to the left side of the top shield.

6. Connect the green/white wire from the yoke to the V-DY connector (Figure 15, #4) and the brown/gray wire to the H-DY connector (Figure 15, #5) on the main electronics assembly.

7. Replace the anode cap (Figure 15, #6).

8. If the yoke has been removed, replace it by sliding the new yoke over the neck of the CRT and tightening the yoke screw (Figure 15, #7).

9. Reinstall the CRT socket (Figure 15, #8).

10. Tiewrap the wires that are in groups, making sure that the chassis tray can slide all the way in and out without binding.

IMPORTANT: *If the yoke was removed or replaced, a yoke adjustment will probably be necessary (see Section 3, Adjustments).*

11. Replace the back case.

❑ FUSE

IMPORTANT: *Newer models of the monitor have clip-in fuse holders and do not require unsoldering or removal of the filter board to change the fuse.*

Materials Needed

Medium Phillips screwdriver (magnetic)
Medium long-nose pliers
Soldering iron and solder

Replace

If the fuse is open (the wire inside is broken), it must be replaced. To replace the fuse:

1. Remove the back case.
2. Discharge the CRT.
3. Locate the line filter board (Figure 16, #1).

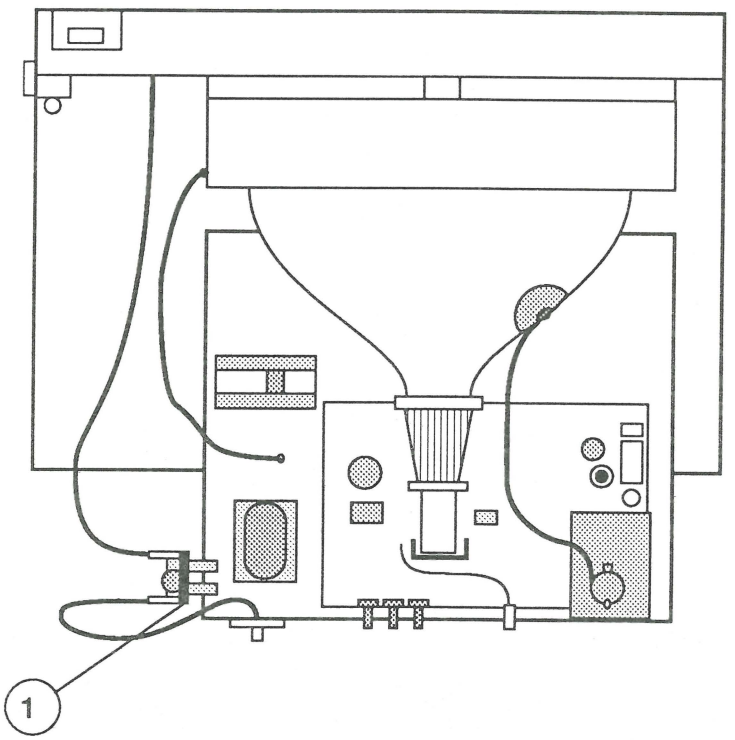


FIGURE 16

4. Remove the following three connectors from the line filter board:

   - AC IN (Figure 17, #1)
   - T1 (Figure 17, #2)
   - SW (Figure 17, #3)

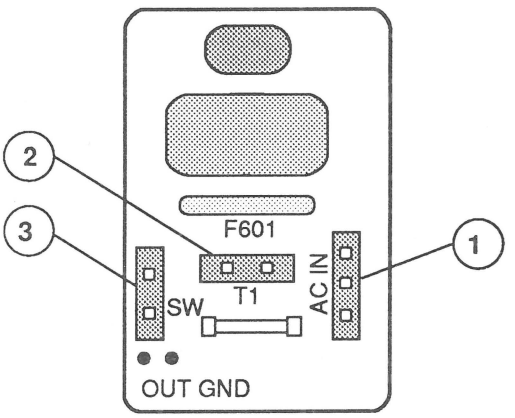


FIGURE 17

5. Remove the Phillips screw that holds the line filter board to the chassis. (Hold the hex nut steady with long-nose pliers.)

6. Unsolder both ends of the fuse wires from the board and lift the fuse from the board. (This type of fuse is called a "pigtail" fuse.)

   Note: This step is easier if you use a solder sucker to remove the excess solder and some kind of holder (such as vise grips) to hold the board while you're working on it.

7. Select the correct fuse: For a 115V unit, use a .5-amp fuse; for a 230V unit, use a 1-amp slow-blow fuse. Install the fuse into the wire holes and resolder the leads. Clip off any excess from the leads after soldering.

8. Remount the line filter board to the chassis using the Phillips screw and hex nut.

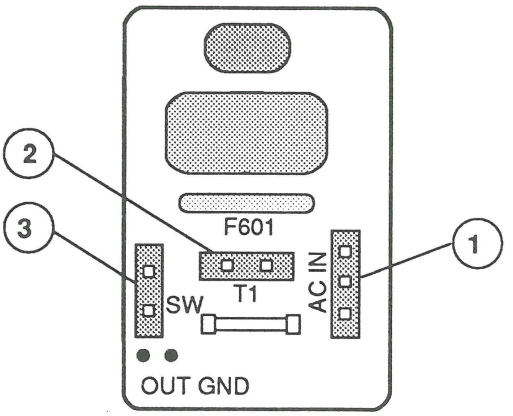


FIGURE 18

9. After reading the note below, reconnect the following three connectors to the line filter board:

   - AC IN (Figure 18, #1)
   - T1 (Figure 18, #2)
   - SW (Figure 18, #3)

   Note: Be careful with SW and T1—both are two-hole connectors and can be put on the wrong posts. T1 comes from the transformer and SW comes from the power switch. Be sure to orient T1 correctly: the board is marked B (black) and W (white) for this connector.

10. Replace the back case.

❑ POWER SWITCH

Materials Needed

Medium Phillips screwdriver (magnetic)
Exacto knife

Remove

1. Remove the back case.
2. Discharge the CRT.
3. Remove the two screws that mount the power switch to the upper-left inside of the bezel.
4. Using diagonal cutters, carefully cut any tie wraps on the switch wires.

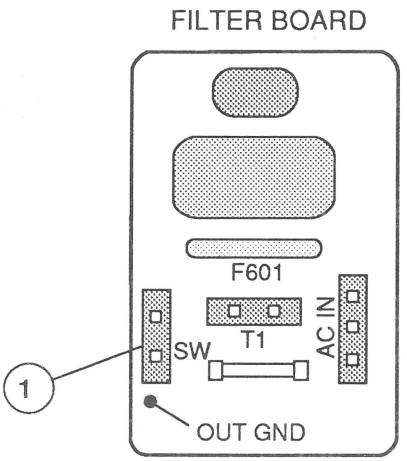


FIGURE 19

5. Disconnect the power switch connector from SW on the line filter board (Figure 19, #1).

Replace

To install the power switch, follow the above procedure in reverse order.

❑ POWER TRANSFORMER

Materials Needed

Medium Phillips screwdriver (magnetic)
Exacto knife

Remove

1. Remove the back case.

2. Discharge the CRT.

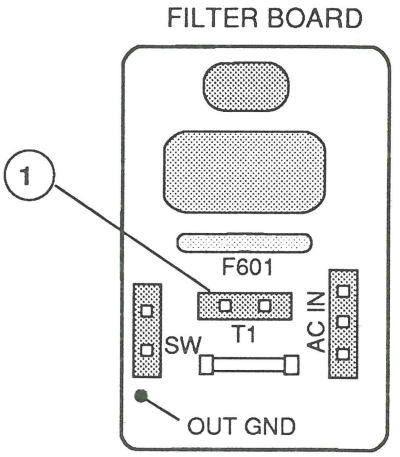


FIGURE 20

3. Disconnect the black-and-white pair of wires from T1 on the line filter board (Figure 20, #1).

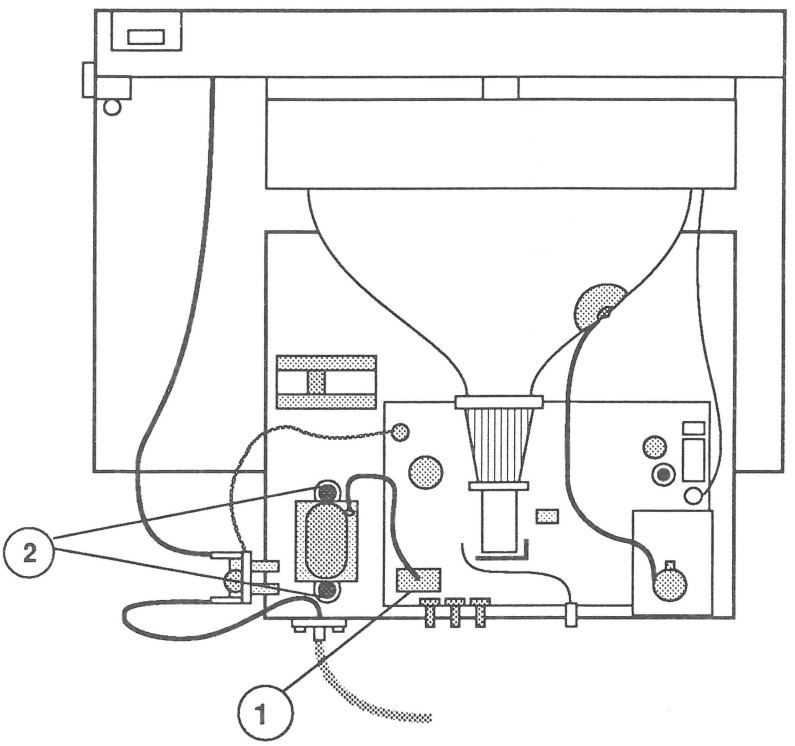


FIGURE 21

4. Disconnect the red pair of wires from T2 on the main electronics assembly (Figure 21, #1).

5. Using diagonal cutters, carefully cut any tie wraps on the transformer wires.

6. Remove the two transformer mounting screws (Figure 21, #2) and lift off the transformer.

Replace

To install the power transformer, follow the above procedure in reverse order.

Apple Technical Procedures

Monitor II/Monochrome Monitor IIe

Section 3 – Adjustments

❑ CONTENTS

3.3 General Information
3.4 Yoke Adjustments
3.6 Set-Up Procedure
3.8 Tilt Adjustment
3.10 Ring Adjustment
3.11 Geometric Adjustments
3.11 Pincushion/Barrel Correction
3.12 Trapezoidal Correction
3.14 Main Electronics Assembly Adjustments
3.15 Set-Up Procedure
3.16 Vertical Adjustments
3.18 Horizontal Adjustments

WARNING: *Some older Monitor II's have the fuse connected to the neutral side of input power. This condition should be corrected.*

Refer to the Power Cord Upgrade Procedure in **Section 5, Additional Procedures,** to identify and correct this condition.

❑ GENERAL INFORMATION

Note: The Monitor II should be tested with the Apple II Peripherals Diskette. (See **Multi-Product Diagnostics Technical Procedures, Section 1.**)

One source of test patterns is not necessarily better than another. The advantage of the Peripherals Diskette is that it can be used with a greater number of systems.

❑ YOKE ADJUSTMENTS

The following procedures are used to adjust the yoke assembly, when necessary, after yoke or CRT replacement. There are three major adjustments that might be needed, depending on whether the picture is tilted, not centered, or geometrically distorted (see Figure 1). They are the tilt adjustment, the centering adjustment, and the geometric adjustment. In some cases, all three adjustments might be needed.

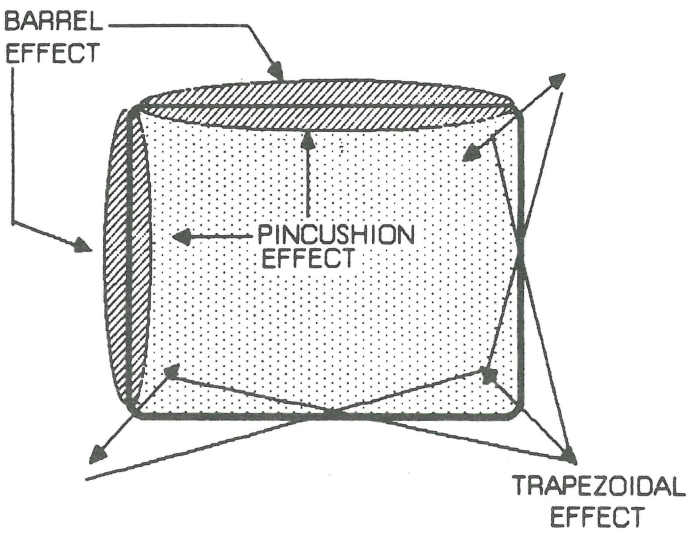


FIGURE 1

Materials Required

Monitor II
Apple II, II Plus, or IIe
Medium Phillips screwdriver
Flexible 12-inch ruler
Apple II Peripherals Diskette or IIe Diagnostic ROM card
Washable fine point marking pen

CAUTION: *There are extremely high voltages on the tube, the anode, and the anode lead. In these adjustments you will be putting your hand near these voltages. You must watch what you are touching or adjusting on the yoke assembly or injury can result. Avoid touching the tube, anode, and anode lead (see Figure 2, #1, 2, and 3). Never hold on to the chassis with your other hand while making these adjustments. Put your other hand in your pocket or behind your back while making these adjustments.*

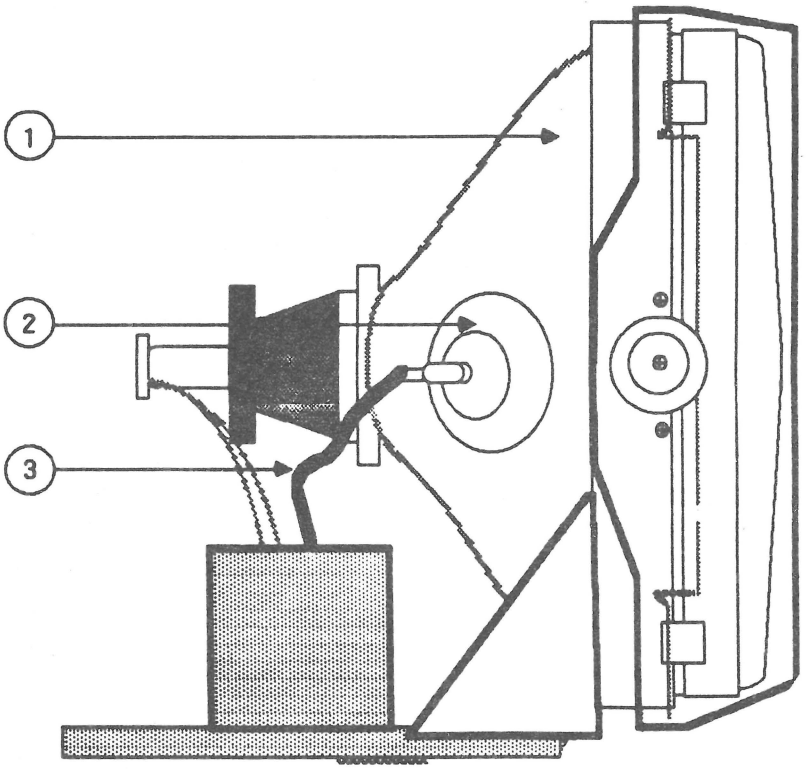


FIGURE 2

Set-up Procedure

1. In order to have some point of reference for centering the image, mark the screen with a washable marker in the following manner:

   a) On the edge of the bezel (the movable part that holds the CRT and tilts up and down - Figure 3, #1), measure half way down from the top (approximately 4 1/4 inches) and make a pencil mark on each side of the bezel (see Figure 3, #3).

   b) Take the flexible ruler and put each end of it on the marks on the bezel. Push the center of the ruler onto the screen and make a 2-inch line on the center of the screen (see Figure 3, #4).

   c) Next, find the two molded markings on the top and bottom of the bezel that look like triangles (see Figure 3, #2). These lines mark the vertical center of the screen.

   d) Put the ruler ends on the center of the triangles and push the center of the ruler against the middle of the screen.

   e) Make a vertical line along the edge of the ruler (see Figure 3, #5); it should intersect with the horizontal line you drew earlier, resulting in a cross (+) on the screen.

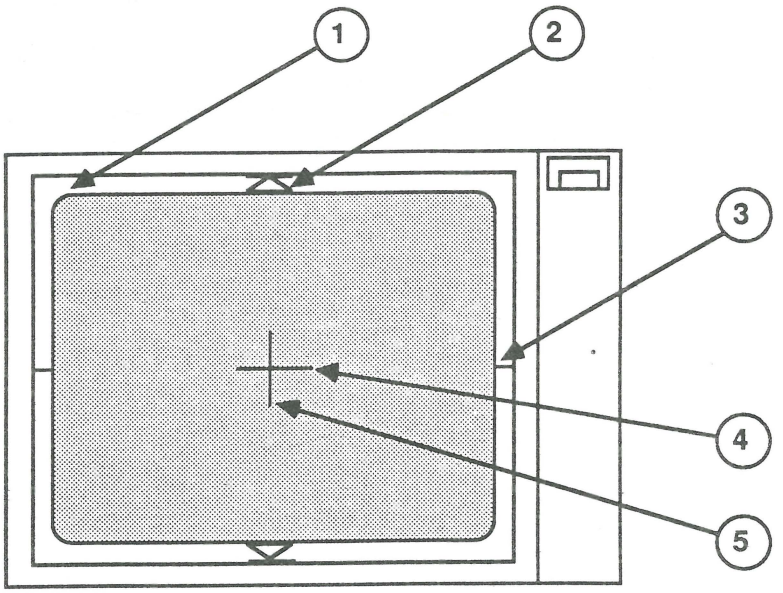


FIGURE 3

2. Remove the Monitor II case (see **Take-apart** section).

3. Connect the video cable from the Monitor II to the Apple II, II Plus, or IIe.

4. If you are using the Apple II Peripherals Diskette, do the following:

   a) Insert the diskette in the disk drive.

   b) Power up the system.

   c) Select "Monitor Tests" from the menu, and choose Test #1 (Dot Pattern).

5. If you are using the IIe Diagnostic ROM card, do the following:

   a) Insert the ROM card into slot 1 or 2 of the IIe.

   b) Make sure the switch on the top of the card is pointing to the rear of the system.

   c) Power up the system.

   d) Select the Video Tests (V) from the menu.

   Note: If the menu does not appear when the power is turned on, and the drive continues to whirl, the switch on the Diagnostic ROM card is in the wrong position. Power off the system, change the switch, and turn the power on.

6. Determine if the pattern on the screen is tilted, centered incorrectly, or geometrically distorted; then proceed to the correct adjustment section as follows:

   a) Picture tilted: Tilt adjustment
   b) Picture not centered: Ring adjustment
   c) Geometric distortion: Geometric adjustment

7. If you are not sure what adjustment is needed, or if all of them seem needed, do all three adjustments in sequence (a, b, and c).

Tilt Adjustment

CAUTION: *There are high voltages on the yoke assembly; handle only the plastic parts of the yoke. DO NOT TOUCH THE WIRES.*

1. If using the Apple II Peripherals Diskette, select "Monitor Tests" from the menu; then select "Test #1" (Dot Pattern). If using the ROM card, select Video Pattern (V).

2. Locate the yoke on the stem of the CRT (see Figure 4).

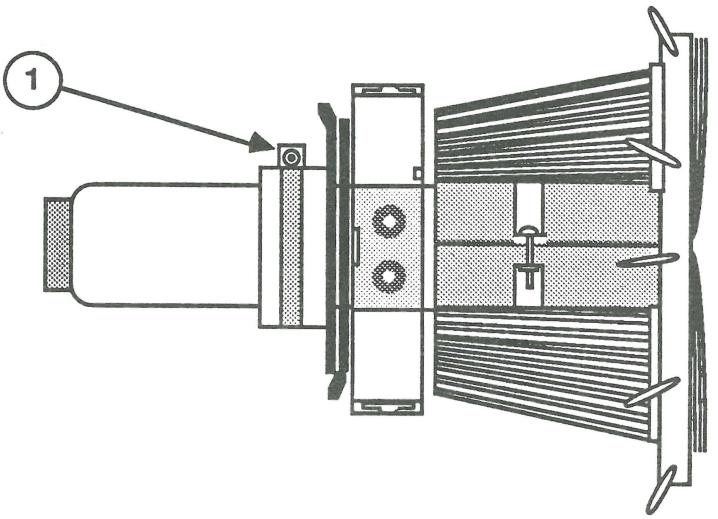


FIGURE 4

3. Locate and loosen the Phillips screw that holds the C-ring on the yoke. The screw is toward the back part of the yoke (see Figure 4, #1). Do not remove the screw; just loosen it enough to make the yoke mobile.

   Note: If the yoke is tacked to the CRT with RTV glue, you will have to cut the glue before you can move the yoke. Power off the monitor and **DISCHARGE THE ANODE** before attempting to make these cuts. (See the discharge procedure under **Main Electronics Assembly** in the **Take-Apart** section.) When the yoke assembly is loose, power on the monitor again.

4. Turn the yoke assembly clockwise and counterclockwise and watch the whole picture tilt. Then gently move the assembly backward and forward on the stem and see how the whole raster can be made smaller or larger.

5. Push the yoke forward on the stem as far as it will go to obtain the largest raster possible. The ideal size raster would fill up most of the screen, leaving a 1/2 inch border on all four sides. You may need to do the main electronics assembly height and width adjustments to get the proper size.

6. Adjust the yoke so that the image is level with the line you drew on the screen or with the top of the screen. If it is hard to tell if it's level, press <ESC> to go back to the menu and choose "Test #2" (Grid Pattern).

7. Retighten the C-ring screw. Be careful not to overtighten, as that could cause damage to the tube stem. Just tighten it enough to be snug.

8. Tack the yoke to the CRT using some RTV glue.

Ring Adjustment

This adjustment is made when the image is not centered. The final result should be that the center of the pattern lines up with the cross lines on the screen.

1. If using the Apple II Peripherals Diskette, select "Test #1" (Dot Pattern) from the menu. If using the ROM card, select Video Pattern (V).

2. Locate the two front and rear ring magnets on the rear part of the yoke (see Figure 5).

3. The ring that is closest to the rear of the yoke (see Figure 5, #2) is the coarse adjustment. Rotate this ring and observe the effect it has on the centering of the image. Position it so that the image is as close to center as possible.

4. Now rotate the front ring (see Figure 5, #3). This is the fine adjustment. Rotate it until the image is centered on the cross lines you put on the screen. It might be necessary to hold the rear ring steady as you move the front one.

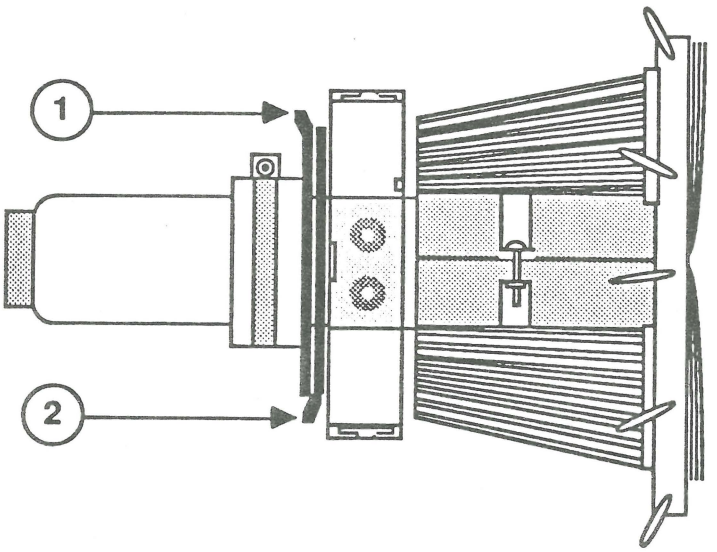


FIGURE 5

Geometric Adjustments

There are two different geometric distortions that can be seen on the screen. One is called pincushioning and barreling (see Figure 6, #1 and #2). The other is the trapezoidal effect (see Figure 7, #1 on the next page). Both are adjusted for with the rotary magnets; however, each adjustment is done separately.

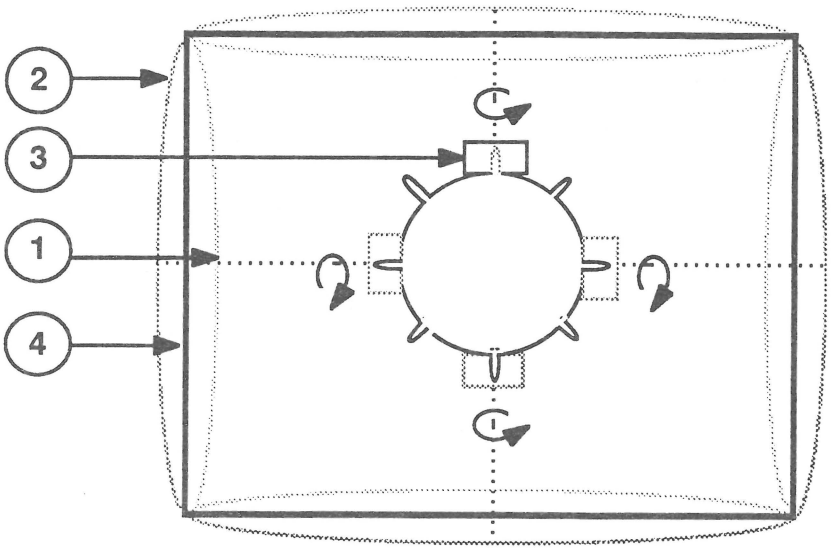


FIGURE 6

Pincushion/Barrel Correction

If the image shows either distortion shown in Figure 6, #1 or #2, correct it by doing the following:

1. If using the Apple II Peripherals Diskette, select "Test #1" (Dot Pattern) from the menu. If using the ROM card, select Video Pattern (V).

2. Push a magnet on the yoke mounting pin as shown in Figure 6, #3. A magnet should be placed only on the pin that corresponds to the affected area.

3. Rotate the magnet to obtain the desired raster (see Figure 6, #4).

4. If the desired raster cannot be obtained, add a second magnet to the same yoke mounting pin. Both magnets must be aligned as in Figure 8, and then rotated simultaneously.

5. Adjust all the sides with magnets until they all line up correctly.

Trapezoidal Correction

Figure 7, #1 shows the trapezoidal effect. Look at your screen and see if any of the corners exhibit the trapezoidal effect. If any do, then perform the following adjustment:

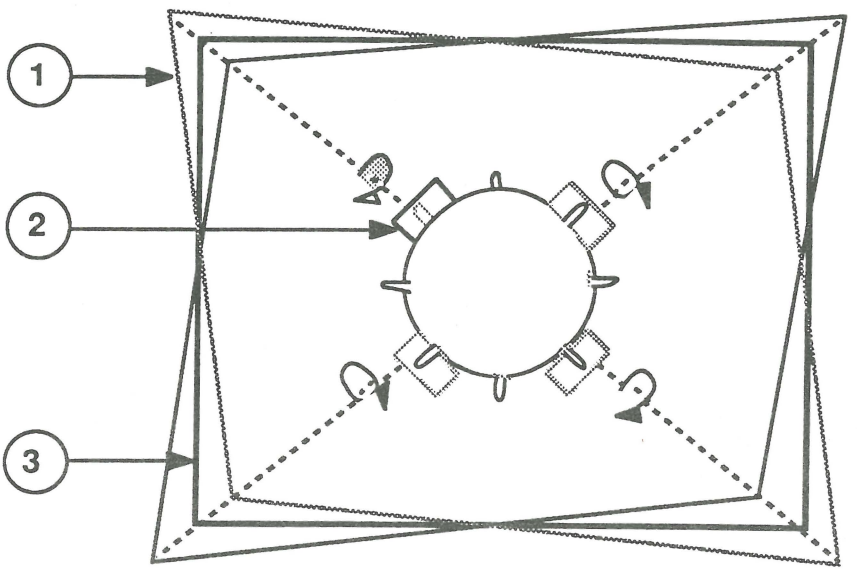


FIGURE 7

1. If you are using the Apple II Peripherals Diskette, select "Test #1" (Dot Pattern) from the menu. If using the ROM card, select Video Pattern (V).

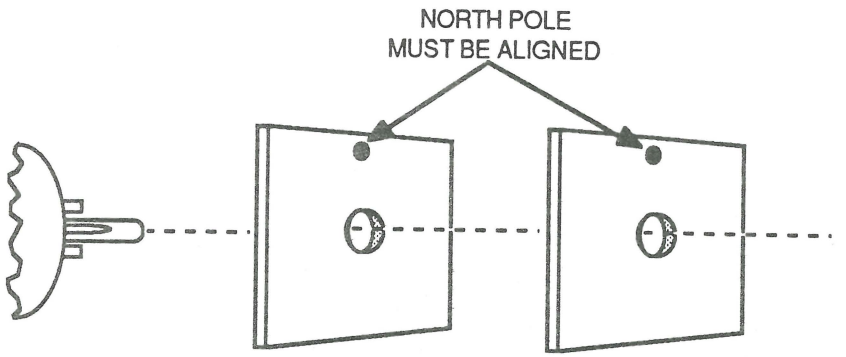


FIGURE 8

2. Push a magnet onto the yoke mounting pin as shown in Figure 7, #2. The magnet should be placed only on the pin that corresponds to the affected area.

3. Rotate the magnet to obtain the desired raster, see Figure 9, #3.

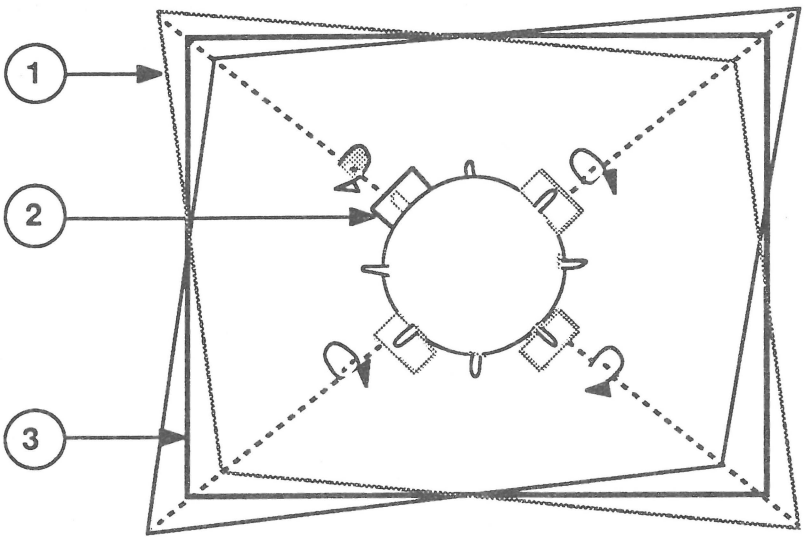


FIGURE 9

4. If the desired raster cannot be obtained, add a second magnet to the same pin. Both magnets must be aligned as in Figure 10, then rotated simultaneously.

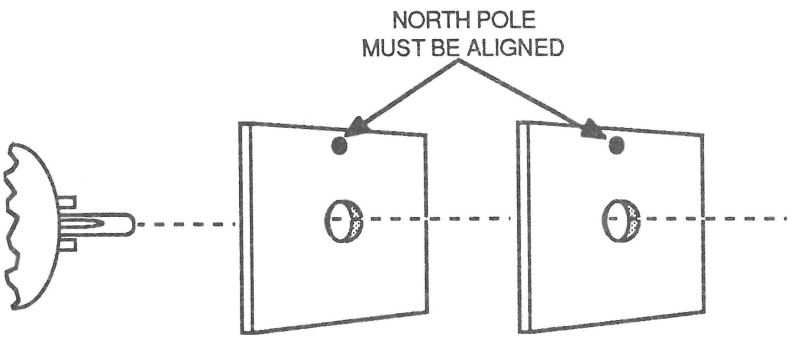


FIGURE 10

5. Do the adjustment until all the corners appear normal.

❑ MAIN ELECTRONICS ASSEMBLY ADJUSTMENTS

After replacement of the Main Electronics Assembly on the Monitor II, the horizontal or vertical alignment may need adjustment. This procedure covers these adjustments. It is important that you read all the steps completely before beginning the adjustments, as several of them interact with each other. If it looks as if a step is not working, it is possible that another step will correct the problem.

Materials Required

Monitor II
Apple II, II Plus, or IIe
Apple II Peripherals Diskette or the Apple IIe Diagnostic ROM Card
Plastic hex tip iron core adjustment tool (size 0.100)
Plastic square-tip coil adjustment tool (size 1/8" square); one manufacturer is Spectrol
Small plastic flatblade screwdriver (tweaker)

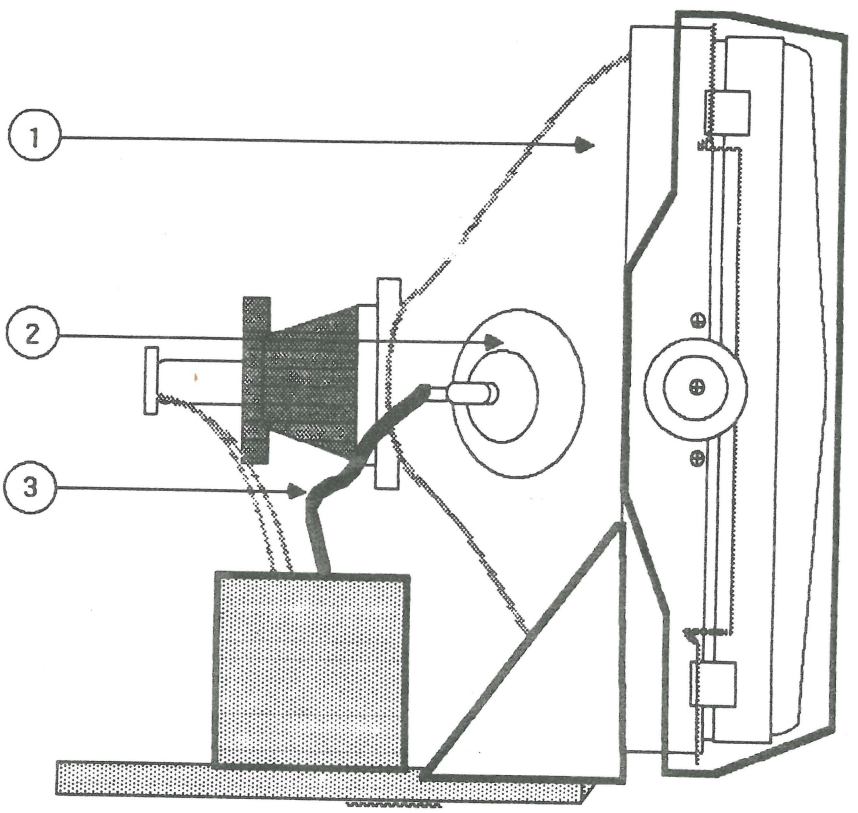


FIGURE 11

CAUTION: *You will be working with a live high voltage picture tube. High voltage is present on the anode of the picture tube, the anode cap, and anode lead, (see Figure 11, #1, 2, and 3, respectively).* ***Do not touch the tube, anode cap, or anode lead: extreme shock can occur.*** *Do not touch or hold on to the chassis with the other hand—keep it behind your back or in your pocket when making the adjustments.*

Set-Up Procedure

1. Remove the Monitor II case (see **Section 2, Take-Apart**).

2. Connect the video cable from the monitor to the Apple II, II Plus, or IIe video output phono jack.

3. If you are using the Apple II Peripherals Diskette, do the following:

   a) Insert the diskette in the disk drive.

   b) Power up the system.

   c) Select "Test #1" (Dot Pattern) from the menu.

4. If you are using the IIe Diagnostic ROM card, do the following:

   a) Insert the ROM card into slot 1 or 2 of the IIe.

   b) Make sure the switch on the top of the card is pointing to the rear of the system.

   c) Power up the system.

   d) Select the Video Tests (V) from the menu.

   Note: If the menu does not appear when the power is turned on, and the disk drive continues to whirl, the switch is in the wrong position. Power off system, change the switch, and turn the power on.

5. View the screen and evaluate the vertical and horizontal alignment and linearity. Determine which one needs correction, and proceed to the correct adjustment. Remember that there is interaction between the two adjustments and that you might have to do both to correct any problems.

Evaluating Alignment

When evaluating the pattern, do not use the dots or grid boxes in the corners as examples: use the middle of the rows. If the corners look incorrect even after adjustments have been made, there may be a yoke alignment problem and you should proceed to that section. Other guidelines to follow for evaluating the vertical and horizontal alignments are as follows:

Vertical

- Do the dots or grid boxes in the top and bottom rows have the same linearity?
- Are the dots or grid boxes stretched out or compressed?
- Is the picture rolling?
- Is the image pushed more to the top or bottom?

Horizontal

- Is the linearity of the dots or grid boxes on both sides of the screen the same?
- Is the width of the characters or boxes the same?
- Is the picture tearing?
- Is the picture rolling in a diagonal movement on the horizontal plane?

❑ VERTICAL ADJUSTMENTS

1. Set the vertical hold control R302 (see Figure 12, #1) near the mechanical center of its rotation. This should lock the picture on the screen and prevent any rolling.

Linearity

2. If the vertical linearity is off, adjust R307 (see Figure 12, #4) until the best linearity is found. Compare top and bottom characters or grid boxes and try to get them even. It's possible to reach the end of the adjustment range of the pot and find that the linearity is still not correct. That's because the height adjustment can affect the linearity. If this happens, leave the pot at the end of its range and proceed to step 3.

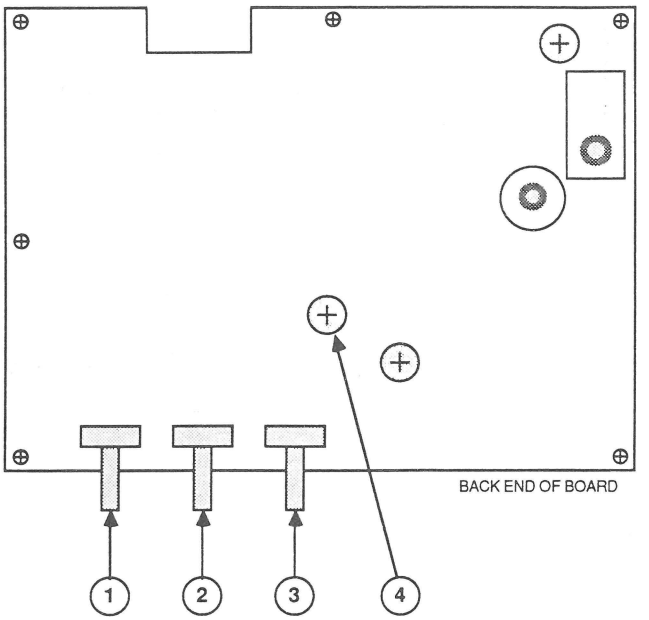


FIGURE 12

Height

3. If the vertical height of the image is incorrect, adjust R305 (see Figure 12, #2) until the desired height is obtained. A good method is as follows:

   a) Turn height control R305 counterclockwise to the end of the pot. The image will compress on the screen but still be legible.

   b) Turn the brightness control R506 (see Figure 12, #3) clockwise until you can see black edges at the top and bottom of the screen. If you don't see black edges on the top and bottom, turn the height pot R305 counterclockwise until the pattern is squeezed and the black area appears. If the pattern becomes blurred, then the brightness control is turned too far.

   c) Adjust the height control R305 so that the black edges just disappear on the top and bottom of the screen. That will make the whole screen green in color and the dots or grid boxes just about the correct height. You can go a little further if you prefer larger characters.

   d) Turn the brightness control R506 counterclockwise until the background on the screen goes black and the pattern is bright.

4. Re-evaluate the vertical linearity of the characters or boxes, as adjusting the height can affect the linearity. If the linearity has changed, repeat step 2 above. However, once adjusted, do not repeat steps 3 and 4 again. Proceed to step 5.

5. If necessary, readjust the vertical hold control R302 (Figure 13, #1) until the picture locks (stops rolling) on the vertical sync.

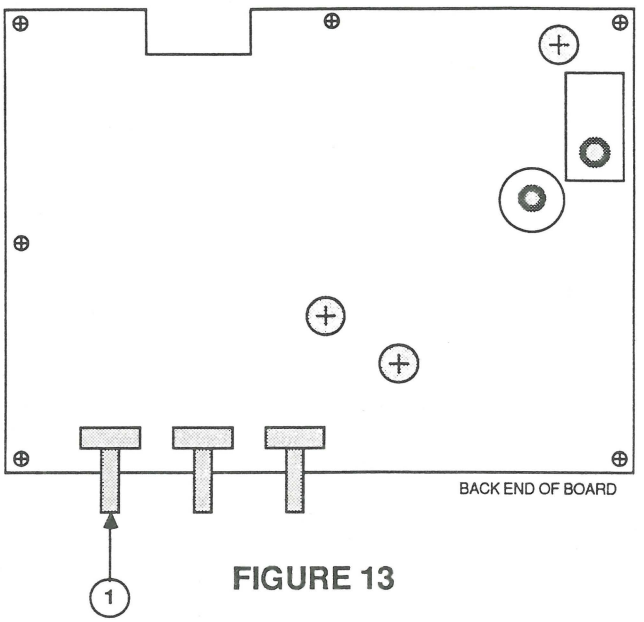


FIGURE 13

6. Turn the monitor off and on and see if the picture rolls. If it does, repeat steps 5 and 6 until it stops rolling.

❑ HORIZONTAL ADJUSTMENTS

1. If the picture on the tube is not locked and centered, or if it is tearing, adjust pot R406 (see Figure 14, #3). Be careful on this adjustment, as you will be physically close to the anode and anode lead in reaching the pot.

2. If the raster will not lock in after adjusting the pot R406 to both ends, it is possible there is a problem with the DC power supply.

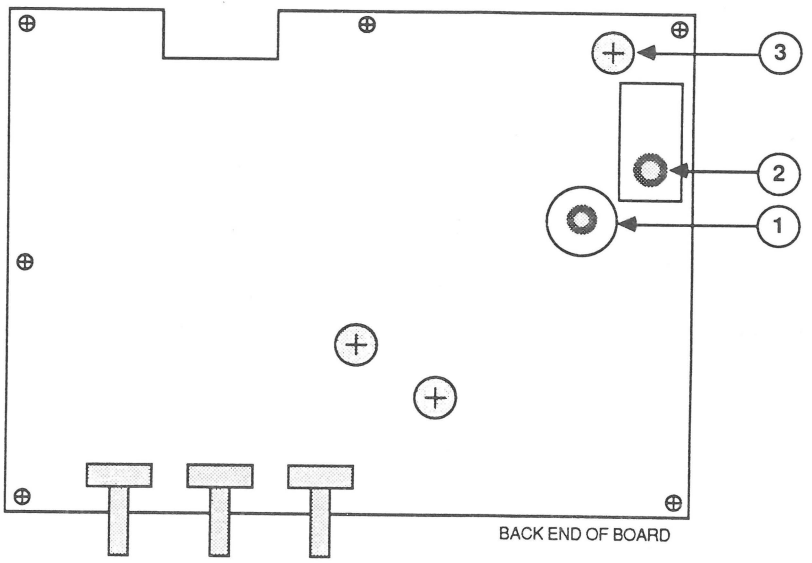


FIGURE 14

3. Observe one row of characters or grid boxes and look for width variations on both sides of the screen. If they are all the same width throughout the row, the linearity is OK, and you can proceed to step 5. If they are not, then adjust the linearity (step 4).

Linearity

4. In most units, the coil L402 (see Figure 14, #2) will be preadjusted and sealed at the factory and you won't be able to change it. In this case, proceed to step 5 and see if the width adjustment will help the linearity. If you do have a unit with an adjustable coil, use the square plastic adjustment tool and turn it until the linearity looks correct. If you have adjusted the coil as far as it will go and the linearity is still wrong, proceed to the width adjustment, step 5.

Width

5. Check the width of the image on the screen. If it looks too narrow or too wide, then use the hex adjustment tool and adjust L401 (see Figure 14, #1) until the desired width is obtained. The image should be an equal distance (approximately 1/2 inch) from each side of the screen, and yet not squeezed together. If the linearity is wrong on one side, this adjustment might correct it. Remember that this is not a centering adjustment; don't squeeze the image just to get it centered.

6. If the unit has an adjustable linearity coil, see if the linearity has changed after step 5. If it has, touch up L402 until the linearity is correct.

7. If all the adjustments have been made and the linearity is still incorrect, suspect a problem with the components on the Main Electronics Assembly.

Apple Technical Procedures

Monitor II/Monochrome Monitor IIe

Section 4 – Troubleshooting

❑ CONTENTS

4.3 Introduction
4.3 Symptom Chart

WARNING: *Some older Monitor II's have the fuse connected to the neutral side of input power. This condition should be corrected.*

Refer to the Power Cord Upgrade Procedure in **Section 5, Additional Procedures,** to identify and correct this condition.

❑ INTRODUCTION

This section contains a symptom chart, showing common problems and the actions to be taken to rectify them. Find the symptom that best describes how the defective monitor appears, and then try the recommended action.

❑ SYMPTOM CHART

Symptom	Action
• *No raster*	1. Check fuse on filter board, replace if blown. 2. Check that all connectors are secure on the filter board and the main electronics assembly. 3. Replace power switch. 4. Replace filter board. 5. Replace main electronics assembly. 6. Replace power transformer. 7. Replace CRT.
• *One horizontal raster line appears*	1. Replace main electronics assembly. 2. Replace yoke.
• *One vertical raster line appears*	1. Replace main electronics assembly. 2. Replace yoke.
• *Raster deformed abnormally*	1. Adjust yoke. 2. Replace yoke.
• *Abnormal raster with winding or excessive picture fluctuation*	– Replace main electronics assembly.

Symptom	Action
• *Spot remains with unit off*	– Replace main electronics assembly.
• *Brightness range abnormal*	1. Replace main electronics assembly. 2. Replace filter board. 3. Replace power transformer.
• *Raster size small, picture abnormally bright (high voltage abnormally high)*	– Replace main electronics assembly.
• *No vertical synchronization*	– Replace main electronics assembly.
• *Raster not centered*	– Turn yoke centering magnets. (See **Yoke Adjustment**.)
• *No picture no contrast*	– Replace main electronics assembly.
• *Picture/characters inclined*	– Turn deflection yoke. (See **Yoke Adjustment**.)
• *Fine noises in picture, characters shiver*	– Replace main electronics assembly.
• *15 or more seconds for picture to appear*	– Change CRT.
• *Picture appears, disappears*	1. Replace main electronics assembly. 2. Replace CRT.

Symptom	Action
• *Horizontal linearity bad*	1. Check horizontal adjustment. (See **Main Electronics Assembly Adjustments.**) 2. Replace main electronics assembly.
• *Vertical linearity bad*	– Check vertical adjustment. (See **Main Electronics Assembly Adjustments.**)
• *Won't focus*	1. Replace main electronics assembly. 2. Replace CRT.
• *Wavy Display*	– Mounting screw on the heat sink is loose.*

***Note:** If a Monitor II starts to exhibit a wavy display, it may be caused by the overheating of the voltage regulator (IC 601). The regulator is mounted on the heat sink near the power transformer.

If the failure occurs after the unit has had time to heat up, it indicates that the mounting screw that secures the voltage regulator to the heat sink is loose. This results in inadequate heat transfer between the two components.

If you must replace the voltage regulator, be sure to use thermal compound or an insulator pad between the voltage regulator and the heat sink.

Apple Technical Procedures

Monitor II / Monochrome Monitor IIe

Section 5 – Additional Procedures

❑ CONTENTS

5.2 Power Cord Upgrade Procedure
5.4 Line Filter Board Modification
5.4 Materials Required
5.4 Resistance Check

❑ POWER CORD UPGRADE PROCEDURE

In older versions of the Monitor II, the power cord conductor wires are not connected to the line filter board connector in the correct sequence. Whenever you open a Monitor II for repair, first check the power cord wiring, as directed below, to see if you need to replace the cord.

1. Disconnect the power cord from the wall outlet and remove the back case (see Section 2, Take-Apart).

2. **Discharge the CRT** (see "Discharging the CRT" in Section 1, Basics).

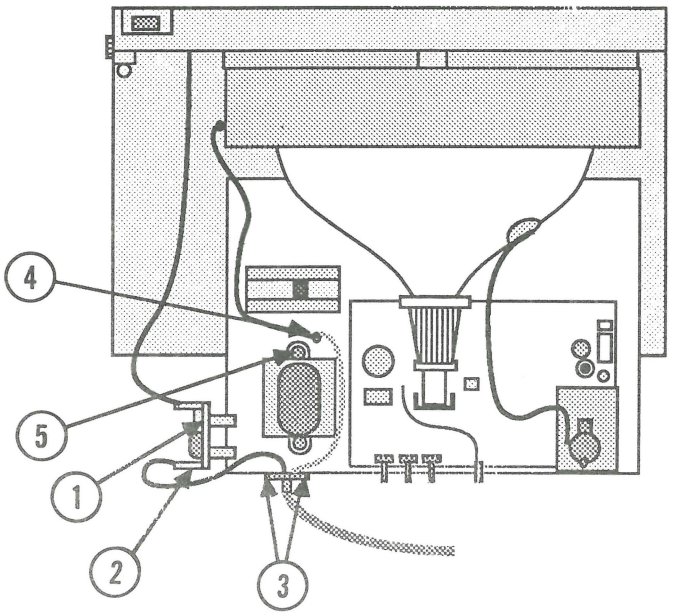


FIGURE 1

3. Locate the line filter board (Figure 1, #1) and AC IN connector (Figure 1, #2).

   If the AC IN connector has only **two** wires (white and black), the monitor is a newer version and does not need a new power cord.

   If **three** conductors (white, black, and green) are wired into the AC IN connector, check the sequence of wires. If the sequence from top to bottom is **black-white-green**, the wiring is incorrect and you must continue to step 4.

4. First, remove the power cord:

   a) Disconnect the AC IN connector from the line filter board.

   b) Remove the two screws (Figure 1, #3) that secure the power cord bracket to the rear of the chassis.

   c) Pull the wires out through the hole in the rear of the chassis.

5. Notice that the new power cord has a tab on the green ground wire (the system's primary ground). In this power cord design, the ground wire attaches to the chassis of the monitor (rather than to the AC IN connector). Follow the steps below to prepare an adequate ground site on the chassis for the power cord ground tab:

   a) Holding the hex nut steady with the long-nose pliers, remove the main chassis ground screw (Figure 1, #4) that secures the black bezel ground wire to the floor of the metal chassis.

   b) Attach the tab of the black bezel ground wire to an alternate site—the screw and nut (Figure 1, #5) that secure the transformer to the metal chassis.

6. Next, install the new power cord:

   a) Thread the wires of the new power cord through the hole in the rear of the chassis.

   b) Replace the two screws (Figure 1, #3) that secure the power cord bracket to the rear of the chassis.

   c) The new version of the power cord has only two conductors (black and white) wired into the AC IN connector. Connect the AC IN connector to the line filter board **with the white wire toward the top**. (If the letters B and W on the line filter board indicate that the black wire should be on top, scratch out the letters and ink in the proper sequence.)

   d) Position the tab of the power cord green ground wire at the main chassis ground site (Figure 1, #4) and replace the screw and nut.

❑ LINE FILTER BOARD MODIFICATION

Due to a change in the line filter board design, some older versions of the Monitor II may not be properly grounded. As a result, some users may be exposed to electrical shock. Whenever you service a Monitor II, check the resistance of the grounding system, as directed below, to verify that the monitor is properly grounded.

Materials Required

Multimeter
Medium Phillips screwdriver (magnetic)
Medium long-nose pliers
Small wire cutters
Soldering iron and solder

Resistance Check

1. Turn the monitor off and disconnect the power cord from the wall outlet.

2. Set up a multimeter to measure resistance (ohms) within the 200-ohm range.

3. Touch the black lead of the multimeter to the AC power cord ground pin (Figure 2, #1).

4. Touch the red lead of the multimeter to the metal casing of the video connector (Figure 2, #2) at the rear of the monitor. (Repeat this procedure several times to be sure you are getting a consistent reading.)

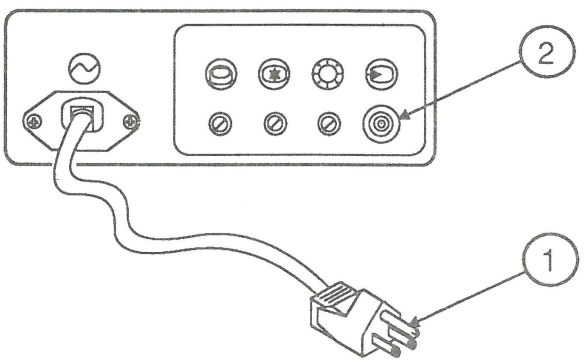


FIGURE 2

5. If the resistance measures between zero and 1 ohm, the monitor is properly grounded, and no further action is required.

6. If the resistance reading is greater than 1 ohm, the monitor is not properly grounded, and you must open the monitor to check the installation of the line filter board.

7. Remove the back case (see Section 2, Take-Apart).

8. **Discharge the CRT** (see "Discharging the CRT" in Section 1, Basics).

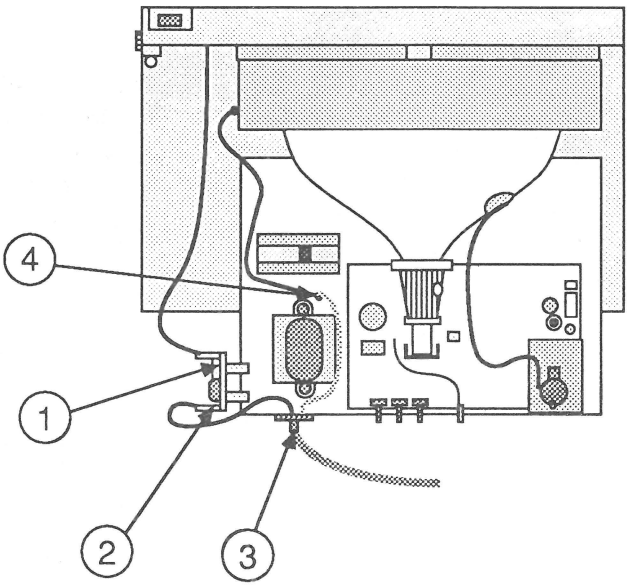


FIGURE 3

9. Locate the line filter board (Figure 3, #1), the AC IN connector (Figure 3, #2), and the monitor power cord (Figure 3, #3).

   a) If the power cord's green ground wire attaches directly to the monitor chassis (Figure 3, #4), the monitor is properly grounded. Proceed to step 19.

...Continued on next page

b) If the power cord's green ground wire is wired into the AC IN connector, you must check the number of AC IN connector pins on the line filter board.

10. Disconnect the AC IN connector (Figure 4, #1) from the line filter board.

    a) If there are **three** AC IN connector pins at the markings **W** (white), **B** (black), and **G** (green) on the filter board, the power cord ground wire is connected to the line filter board circuitry, and the monitor is properly grounded. Reconnect the AC IN connector (Figure 4, #1) to the line filter board, and proceed to step 19.

    b) If only **two** AC IN connector pins are on the filter board at the markings **W** (white) and **B** (black), the ground pin is deleted, and the monitor is not grounded when used with the three-wire AC IN connector. Follow the steps beginning on the next page to replace the deleted ground.

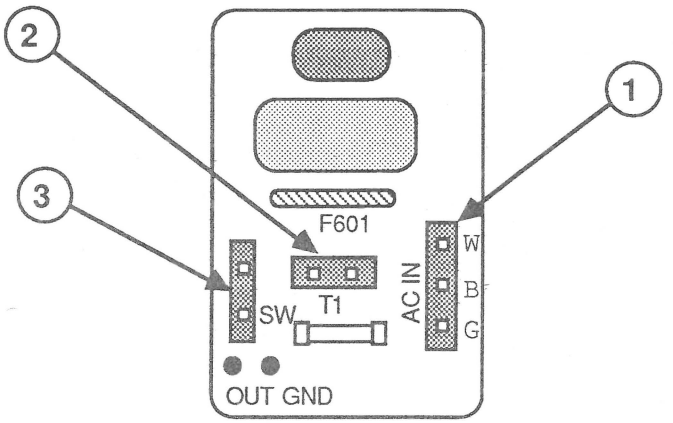


FIGURE 4

11. Disconnect the following two connectors from the line filter board:

    - T1 (Figure 4, #2)
    - SW (Figure 4, #3)

12. Remove the Phillips screw that holds the line filter board to the chassis. (Hold the hex nut on the back side of the screw with the long-nose pliers.)

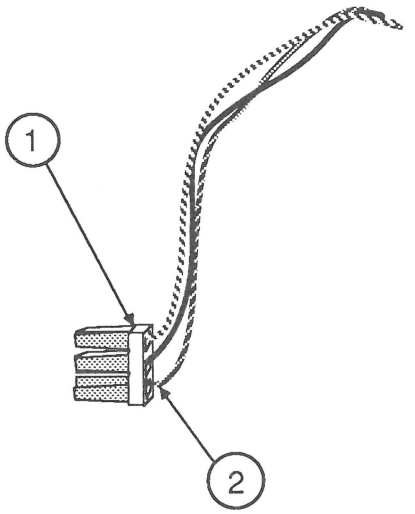


FIGURE 5

13. Locate the three-wire AC IN connector (Figure 5, #1) that you removed from the line filter board.

14. Using small wire cutters, clip off the green AC IN ground wire close to the connector (Figure 5, #2).

15. On the line filter board, locate the solder point (Figure 6, #4) next to the green ground wire at the marking "OUT GND" (Figure 6, #5), and desolder if there is solder present.

16. Solder the green AC IN ground wire that you just clipped to the filter board at the solder point (Figure 6, #4) next to the green ground wire (Figure 6, #5) at the marking "OUT GND."

17. Remount the line filter board to the chassis using the Phillips screw and hex nut.

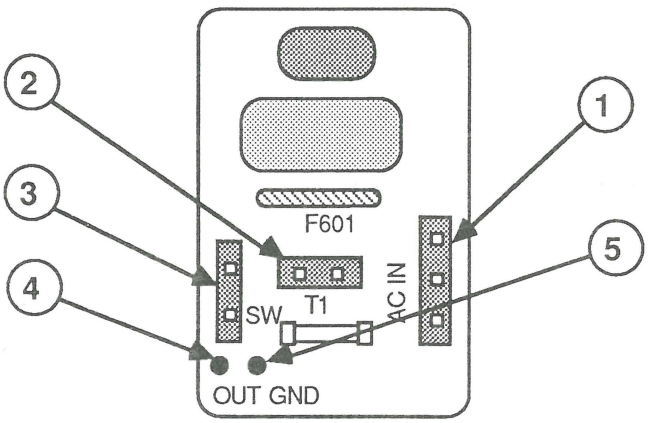


FIGURE 6

18. After reading the note below, reconnect the following three connectors to the line filter board:

    - AC IN (Figure 6, #1)
    - T1 (Figure 6, #2)
    - SW (Figure 6, #3)

    Note: Be careful with SW and T1—both are two-hole connectors and can be put on the wrong posts. T1 comes from the transformer, and SW comes from the power switch. Be sure to orient T1 correctly: the board is marked B (black) and W (white) for this connector.

19. Replace the back case (see Section 2, Take-Apart).

Apple Technical Procedures

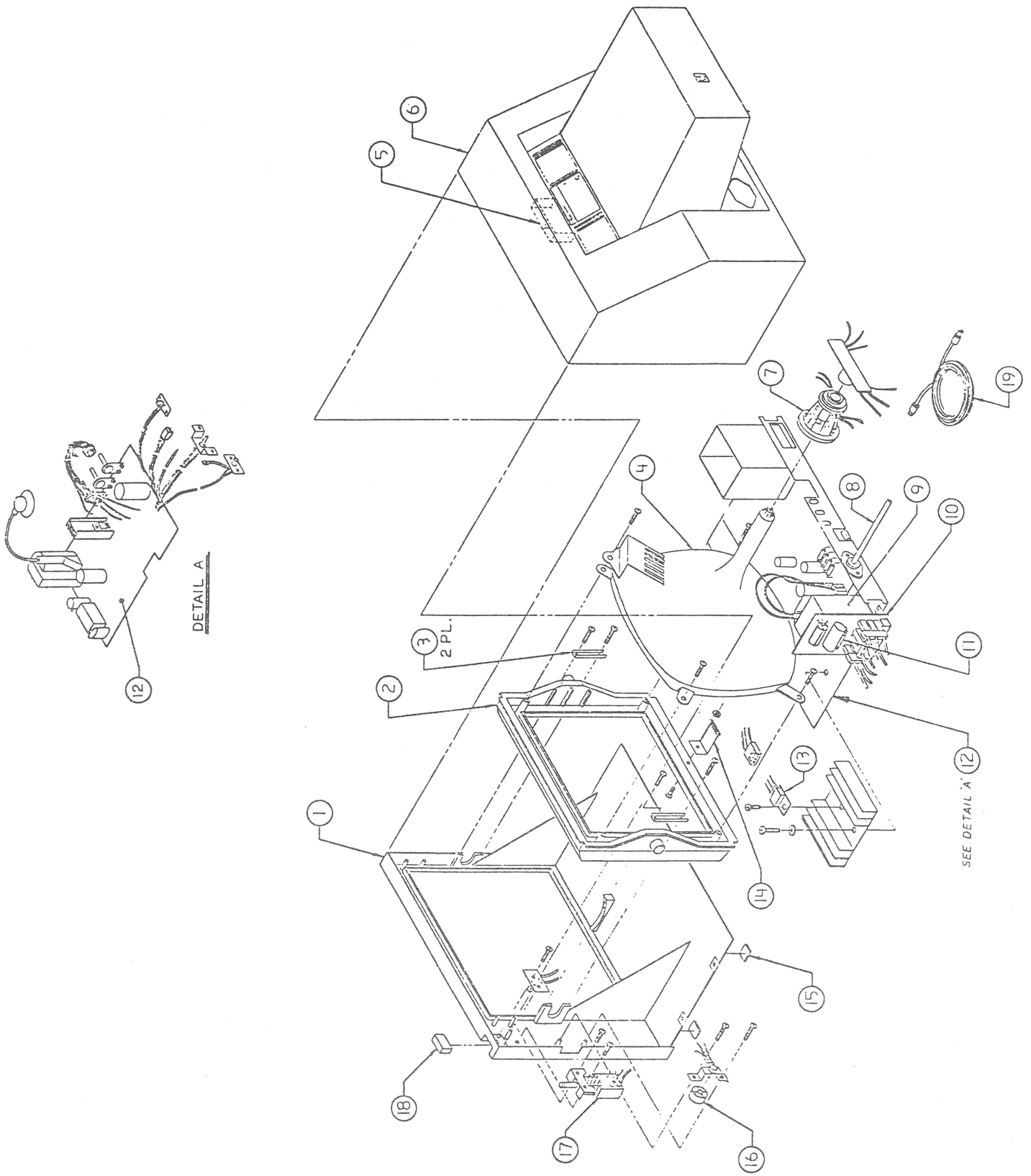
Monitor II / Monochrome Monitor IIe

Illustrated Parts List

❑ CONTENTS

IPL.3 Monitor II/Monochrome Monitor IIe

The figures and lists below include all piece parts that can be purchased separately from Apple for the Monitor II/ Monochrome Monitor IIe, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.


DETAIL A
2 PL.
SEE DETAIL 'A'
1
2
3
4
5
6
7
8
9
10
11
12
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14
15
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19

❑ MONITOR II / MONOCHROME MONITOR IIe

Item	Part No.	Description
1	815-0779	Bezel Enclosure, Beige
	815-1049	Bezel Enclosure, Platinum
2	815-0780	Mask Enclosure, Beige
	815-1050	Mask Enclosure, Platinum
3	805-0200	Pivot Retaining Plate
4	076-0099	Monitor II CRT Module
5	815-0786	Handle Cavity Filler, Beige
	815-0559	Handle Cavity Filler, Platinum
6	815-0778	Rear Housing Enclosure, Beige
	815-1048	Rear Housing Enclosure, Platinum
7	970-0453	Deflection Yoke
8	970-0629	Power Cord
9	970-0447	Power Transformer, 115V
10	699-0211	Line Filter PCB
11	740-0106	Quick Acting Fuse, .5A, 250V (Domestic, 110V only)
	740-0011	Quick Acting Pigtail Fuse, .5A, 250V (Domestic, 110V only)
	740-0200	Slow Blow Fuse, 1A, 250V (Euro/Intl only)
	740-0070	Slow Blow Pigtail Fuse, 1A, 250V (Euro/Intl only)
12	661-75134	Main Electronics Assembly
13	353-7815	IC, 7815, 15V POS. Volt Reg. IC601
14	805-0202	Ratchet Spring
15	865-0020	Foot, .81 In Sq, .35 In Thk, Black
16	815-0781	Contrast Knob, Beige
	815-1051	Contrast Knob, Platinum
17	970-0445	Power Switch Assembly, 120V
18	815-0787	Power Switch Knob, Beige
	815-1052	Power Switch Knob, Platinum
19	590-0539	Video Cable, Smoke

APPLECOLOR COMPOSITE MONITOR IIe/IIc
and COLOR MONITOR IIe/IIc
TECHNICAL PROCEDURES

Except for case color, the AppleColor Composite Monitor IIe is identical to the ColorMonitor IIe, Series "H," and the AppleColor Composite Monitor IIc is identical to the ColorMonitor IIc, Series "S." In both cases, the procedures for the AppleColor Composite Monitor are the same as for the corresponding ColorMonitor.

Apple Technical Procedures

AppleColor Composite Monitor IIe/IIc and ColorMonitor IIe/IIc

Technical Procedures

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	3S.7	Rear Cover (IIe only)
	3S.11	Discharging the Cathode-Ray Tube (CRT)
	3S.11	Discharge Procedure
	3S.13	Anode Cap
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3H.11 Anode Cap
3H.12 Main Logic PCB (Rev. A only)
3H.28 Main Logic PCB (Rev. B only)
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3H.46 LED Assembly (IIe only)
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4.3 Introduction
4.5 Text (Black and White) Adjustments
4.7 Color Adjustments
4.7 Color Adjustment Procedure Series "S"
4.11 Color Adjustment Procedure Series "H"

Section 5 – Illustrated Parts List

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5.3 ColorMonitor IIe, Series "S"
5.5 AppleColor Composite Monitor IIe and ColorMonitor IIe, Series "H"
IIc Monitors
5.7 AppleColor Composite Monitor IIc and ColorMonitor IIc, Series "S"
5.9 ColorMonitor IIc, Series "H"
5.11 Series "H" Monitors — Packaging

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Apple ColorMonitor IIe/IIc
Technical Procedures

Section 0

Service Notes

Contents:

Upgrade Procedure for Fuse F901 (to 4 Amp 125V).....0.5
LED Polarity Reversal Procedure - Series H.....0.9

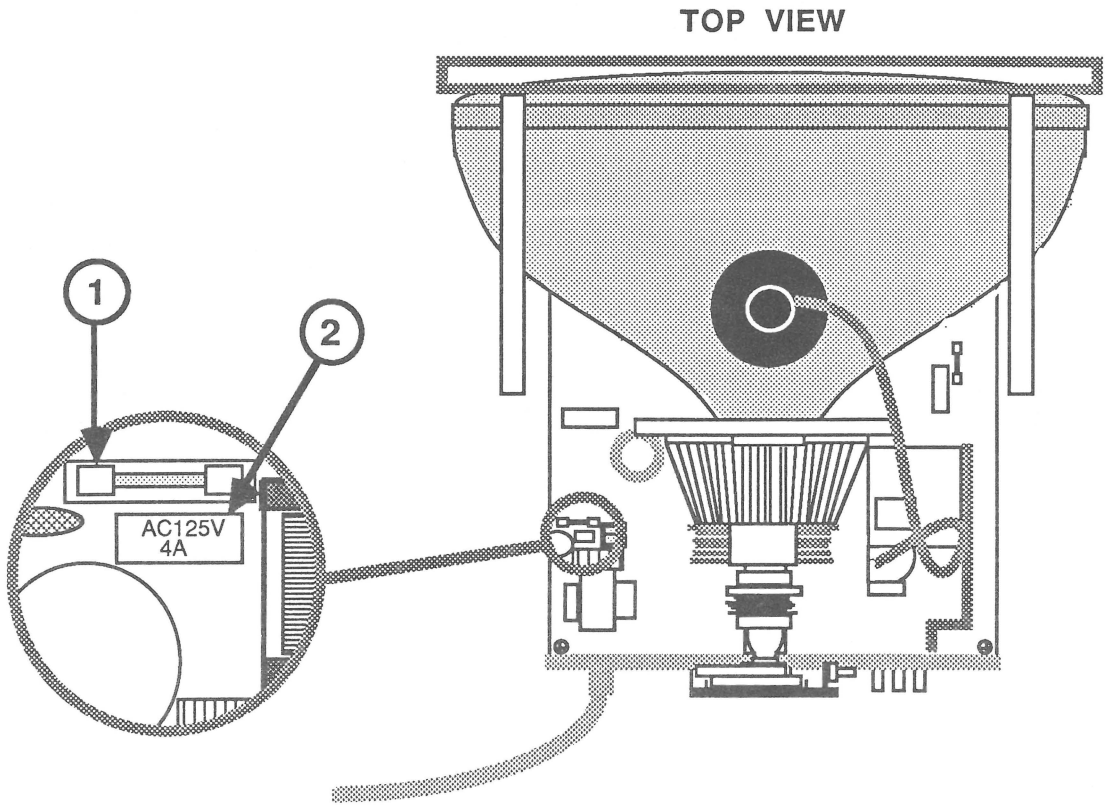


FIGURE 1

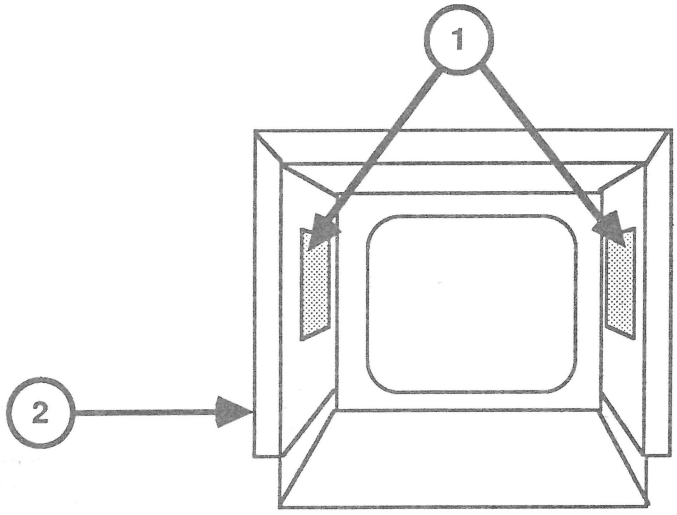


FIGURE 2

UPGRADE PROCEDURE FOR FUSE F901 (to 4 Amp 125V) - Series H

SERVICE NOTE: After extensive testing, the 3.15 Amp 250V fuse (F901) in the ColorMonitor IIe/IIc (Series H) has been shown to have a 1% failure rate. All 3.15 Amp fuses must be replaced with 4 Amp 125V fuses when they fail, or when any type of monitor problem occurs (for instance, when CRT is replaced). Also, you should replace any 3.15 Amp fuse that is currently in your Miscellaneous Hardware Kit with a new 4 Amp 125V fuse.

The Fuse Kit for the ColorMonitor IIe/IIc includes:

The correct 4 Amp 125 V medium blow fuse
Two large labels (in English and French)
    for the inside of the monitor case
One small label for the logic board
Installation instructions

IMPORTANT: If you have not completed steps 1 through 4 of "Replacing the Logic Board Fuses (F901 and F902) - Series H" (in **Section 3, Take-Apart**), you must do so now before beginning this procedure.

1. Replace fuse F901 (Figure 1, #1) with the new 4 Amp 125V fast blow fuse.

2. Attach the small label (Figure 1, #2) below the fuse holder (F901).

3. Attach the two large labels (Figure 2, #1) over the existing labels to the inside wall of the ColorMonitor rear cover (Figure 2, #2).

   NOTE: The label on the left side is written in French and the one on the right in English. Be sure to attach each label to its proper position.

4. Carefully set the monitor on its face on a protective pad.

CONTINUE ON NEXT PAGE

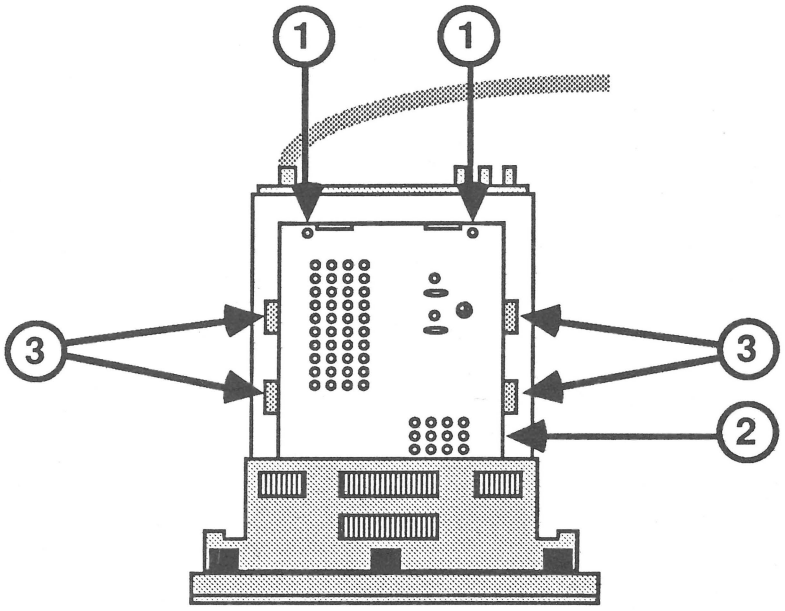


FIGURE 3

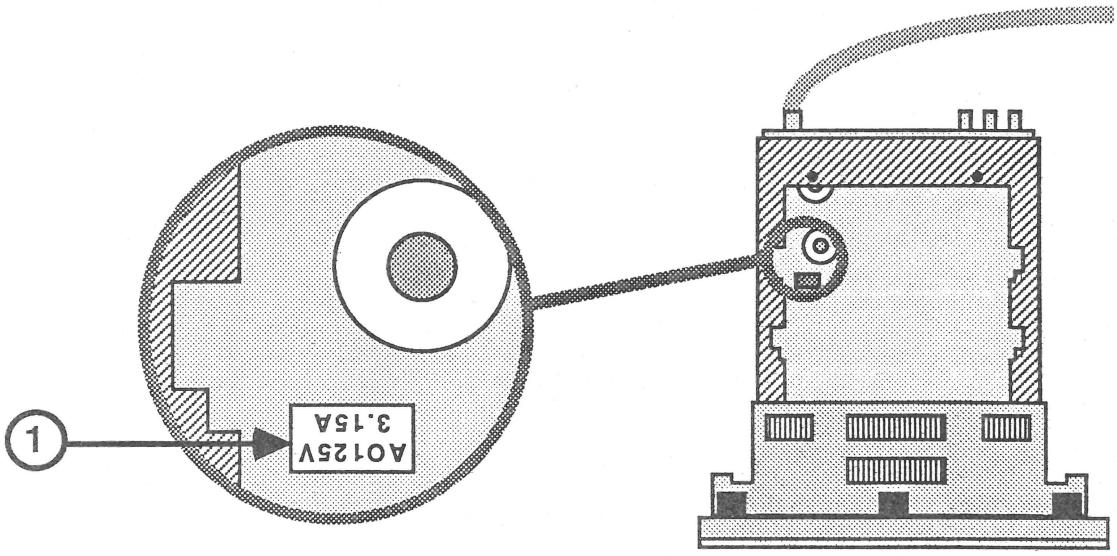


FIGURE 4

5. Remove the two screws (Figure 3, #1) that secure the bottom panel of the main logic PCB.

6. Remove the bottom panel (Figure 3, #2) from the main logic PCB.

7. Use a dark colored felt pen to blacken out the fuse information (Figure 4, #1) on the main logic PCB.

8. Replace the bottom panel and secure the two screws (Figure 3, #1) to the main logic PCB. Make sure that the four metal teeth (Figure 3, #3) are aligned before tightening the screws.

9. Replace the rear cover. (See "Replacing the Rear Cover" in **Section 3, Take-Apart.**)

10. Connect the AC power cord.

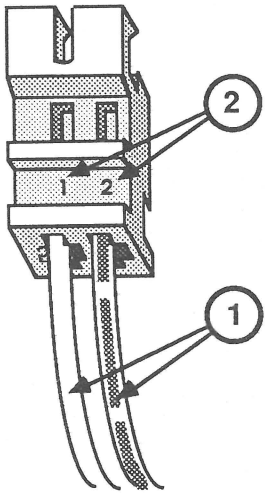


FIGURE 5

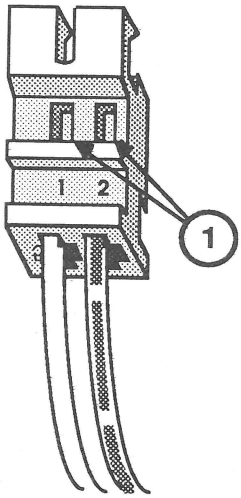


FIGURE 6

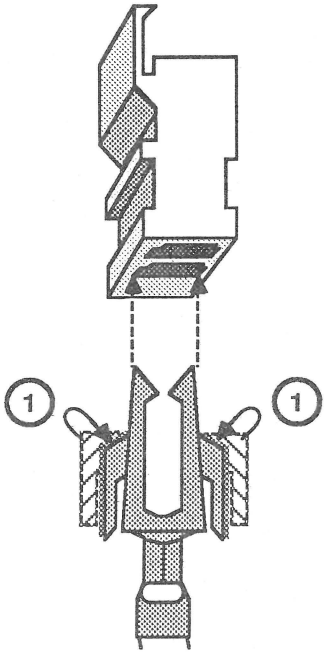


FIGURE 7

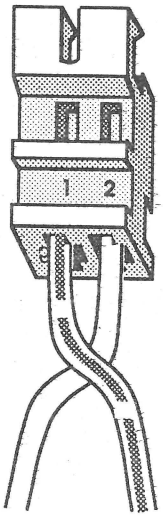


FIGURE 8

LED POLARITY REVERSAL PROCEDURE - SERIES H

On the ColorMonitor IIe, Series H, the polarity of the LED circuitry on the Rev. B logic board is reversed from that of the Rev. A. If you have made a logic board replacement and find that the LED does not work, follow the procedure below.

1. Remove the cover and discharge the CRT. (See **Section 3, Take-Apart.**)

2. Disconnect the LED connector from the logic board (for Rev. B) or from the small, vertically mounted video PCB attached to the logic board (for Rev. A). (For position of connector on board, refer to "Removing the Main Logic PCB - Series H" in **Section 3, Take-Apart.**)

   NOTE: The LED does **not** have to be removed from the bezel for this procedure.

3. The LED leads are color-coded (Figure 5, #1). Note which color is in which numbered side (Figure 5, #2).

4. Using the tip of a screwdriver, press in on the two small holes on each side of the connector (Figure 6, #1) to compress the metal lead tabs inside.

5. Pull the lead tabs out of the connector (Figure 7).

6. Straighten out the little metal teeth on the edges of the tabs where they were bent by the screwdriver tip (Figure 7, #1). These teeth must be separated enough from the tabs to snap back onto the connector holes on reinsertion.

7. Reverse the position of the leads and replace them in the connectors according to the orientation shown by the dotted lines in Figure 7. Push the leads in until the teeth snap into the connector holes (Figure 8). Tug on the leads to make sure they are seated securely.

8. Reconnect the LED connector to the logic board (Rev. B) or small video PCB (Rev. A). (Refer to "Replacing the Main Logic PCB - Series H" in **Section 3, Take-Apart.**)

9. Replace the cover. (See **Section 3, Take-Apart.**)

10. Power on the monitor to make sure the LED lights. If it does not, replace the LED.

Apple Technical Procedures

Apple ColorMonitor IIe/IIc

Section 1 – Basics

❑ CONTENTS

1.2 Product Description
1.4 Version Identification
1.4 ColorMonitor Series Identification
1.4 AppleColor Composite Monitor Versions
1.5 Series "H" Logic Board Revisions

❑ PRODUCT DESCRIPTION

The AppleColor Composite Monitor IIe/IIc (formerly called the ColorMonitor IIe/IIc) is a 14-inch display monitor operated with a composite video input signal. This means that it uses a standard RCA phono jack to connect the monitor input to the computer's video output jack. The power switch for the IIc version is on the top right side of the case (as you face the screen). It will stay depressed when the unit is on (Figure 1, #1).

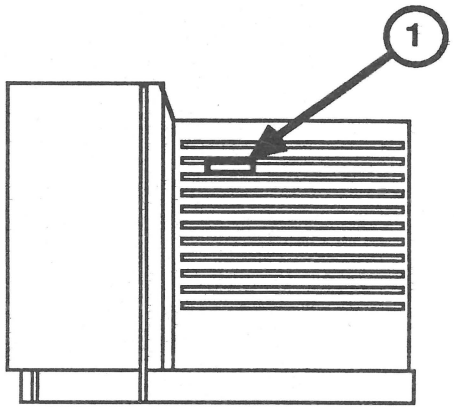


FIGURE 1

The power switch for the IIe version is at the front of the monitor on the lower right side (Figure 2, #1).

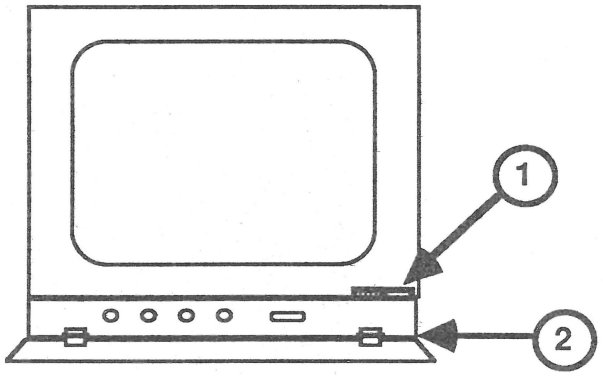


FIGURE 2

For both the IIe and the IIc versions of the monitor, frequently used controls are located behind a protective door (Figure 2, #2) on the bottom front of the monitor. Less frequently used controls are on the back of the monitor. Internationally recognized symbols, shown in Figure 3, are used to identify the various controls.

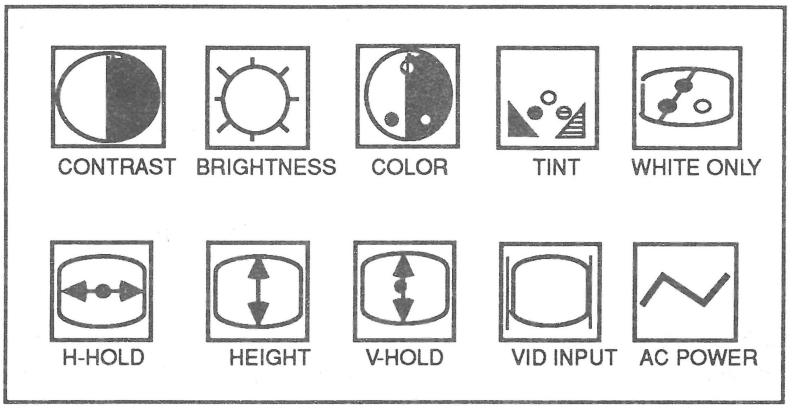


FIGURE 3

The AppleColor Composite Monitor IIe/IIc contains a cathode-ray tube (CRT), which operates at very high voltages and contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself), showering glass in all directions.

WARNING: Before working inside this monitor, read Section 8, CRT Safety, under the* You Oughta Know *tab.

❑ VERSION IDENTIFICATION

Two vendors supplied Apple with the original ColorMonitor IIe/IIc. The two vendors' interior designs are referred to as Series "S" and Series "H." Both vendors manufactured both case versions: the IIe case version in beige and the IIc case version in white. So, originally, we had four versions:

ColorMonitor IIe, Series "S" (beige)
ColorMonitor IIc, Series "S" (white)

ColorMonitor IIe, Series "H" (beige)
ColorMonitor IIc, Series "H" (white)

ColorMonitor Series Identification

You can use the following criteria to differentiate between Series "S" and Series "H" ColorMonitor IIe/IIc monitors:

- Series "S" monitors have two plastic hinges with metal pins on the bottom front door of the monitor case.
- Series "H" monitors have three entirely plastic hinges that bend along a preset crease in the bottom front door of the monitor case.

AppleColor Composite Monitor Versions

When the case color of both the IIe and the IIc monitors was changed to platinum, the name was changed also—to the AppleColor Composite Monitor IIe/IIc. At the same time, the production of new monitors was segmented by vendor so that the new AppleColor Composite Monitor IIc appears only in the Series "S" design, and the new AppleColor Composite Monitor IIe appears only in the Series "H" design:

- AppleColor Composite Monitor IIc, Series "S" only (platinum)
- AppleColor Composite Monitor IIe, Series "H" only (platinum)

Series "H" Logic Board Revisions

Finally, there are two versions (Rev. A and Rev. B) of the Series "H" logic board (both in finished goods monitors and in service modules). The major differences between the two revisions are given below:

Rev. A	Rev. B
Rear panel/AC power cord assembly detaches from logic board (two separate modules)	Power cord soldered to logic board (one module)
Separate power supply board Separate video board	Logic board design includes power supply and video functions
Isolation transformer on AC power circuit	**No Isolation Transformer: Dangerous If Plugged in BACKWARDS!**

Apple ColorMonitor IIe/IIc
Technical Procedures

Section 2

Troubleshooting

Introduction.....2.2
Troubleshooting Guide.....2.3

INTRODUCTION

This troubleshooting section consists of a symptom chart showing each symptom and a list of fixes.

DO THIS FIRST: There are two series of ColorMonitor IIe/IIc. Use the following criteria to identify the series of ColorMonitor IIe/IIc that you are troubleshooting:

* **Series "S"** monitors have two plastic hinges with metal pins on the lower front door of the monitor.

* **Series "H"** monitors have three entirely plastic hinges which bend along a preset crease.

IMPORTANT TERMS: There are two parts to the display on a monitor:

Video - The information (characters, graphics, etc.) on the display. The video is usually displayed over the raster (described below) so that the raster is not visible.

Raster - The lit portion of the screen which is usually covered by video so that it is not visible. When the raster is displayed by itself with no video, it looks like a blank white box.

DIRECTIONS:

* In the table beginning on the opposite page, find the symptom which most closely resembles that exhibited by the defective monitor. Then try the recommended action(s) in the order listed.

* If a recommended action specifies **Series "S"** or **Series "H,"** perform it only if your monitor is of that series (refer to DO THIS FIRST above for more information).

* If neither **Series "S"** nor **Series "H"** is specified, the recommended action is applicable to both.

* If the problem still exists after trying the actions listed, contact your Regional Technical Support Center for assistance.

SYMPTOM	ACTION
NO RASTER	Adjust the external BRIGHTNESS control on front panel. **Series "S"** - Check fuse 871 on the power supply PCB; replace if blown. **Series "H"** - Check fuse 901 on the main logic board; replace if blown. Check that all connectors are secure on power supply and main logic PCBs. **Series "S"** - Replace power supply board. **Series "S"** - Replace rear panel/AC cord. Replace main logic PCB. Replace power switch. Replace CRT.
ONE HORIZONTAL LINE APPEARS	**Series "S"** - Check to make sure that the internal service switch (SW800) is in NORMAL position. Refer to Series "S" color adjustment procedure (in "Adjustments" section) for switch location. Check yoke connector. Replace main logic PCB. Replace CRT.
ONE VERTICAL LINE APPEARS	Check yoke connector. Replace main logic PCB. Replace CRT.
ONE SIDE OF THE RASTER IS A DIFFERENT HEIGHT THAN THE OTHER (keystone effect)	Replace CRT.

SYMPTOM	ACTION
ABNORMAL RASTER (other than above)	Check to make sure all connectors are correctly seated and in right places on the PCBs. Replace main logic PCB.
HORIZONTAL LINEARITY BAD	Replace main logic PCB.
MONITOR MAKES HIGH PITCHED NOISE	Replace main logic PCB. **Series "S"** - Replace power supply board.
RASTER IS SMALL AND ABNORMALLY BRIGHT	Check yoke connector. Replace main logic PCB. Replace the CRT.
NO VERTICAL SYNCHRONIZATION	Set external VERTICAL HOLD control on back panel. Replace main logic PCB.
RASTER NOT CENTERED	Replace main logic PCB.
CAN'T ADJUST COLOR, CONTRAST, BRIGHTNESS, ETC.	Replace main logic PCB.
CHARACTERS JITTER	Make sure all ground straps are secure. Verify adjacent computer equipment is properly grounded. **Series "S"** - Replace power supply PCB. Replace main logic PCB.
VERTICAL LINEARITY BAD	Replace main logic PCB.
BLACK SPOT REMAINS WHEN UNIT IS OFF (burnt phosphor)	Replace CRT.

SYMPTOM	ACTION
PICTURE TOO DARK OR TOO BRIGHT	Adjust external BRIGHTNESS control (on front panel). **Series "S"** - Adjust internal SUB-BRIGHTNESS control. Refer to Series "S" color adjustment procedure (in "Adjustments" section) for location. Replace main logic PCB.
OUT OF FOCUS	Replace main logic PCB. Replace CRT.
RASTER IS ONE PREDOMINANT COLOR	See color adjustment procedure (in "Adjustments" section). Replace main logic PCB.
NO COLOR	Make sure that software is supposed to display in color. Make sure WHITE ONLY switch is in "out" position. Replace main logic PCB.
INCORRECT COLORS	If colors are very seriously out of adjustment, adjust internal color controls (see "Adjustments" section).
MONITOR TURNS ITSELF OFF	Replace main logic PCB.
FLASHING OR WAVY SCREEN	Gently crimp the metal connector tabs on the video connector.

Apple Technical Procedures

Apple ColorMonitor IIe/IIc

Section 3 – Take-Apart Series "S"

❑ CONTENTS

3S.2 Rear Cover (IIc only)
3S.7 Rear Cover (IIe only)
3S.11 Discharging the Cathode-Ray Tube (CRT)
3S.11 Discharge Procedure
3S.13 Anode Cap
3S.14 Main Logic PCB
3S.28 Power Supply/Panel/AC Cord Assembly
3S.32 Cathode-Ray Tube (CRT)
3S.34 Control PCB
3S.36 White-Only Switch
3S.38 On/Off Switch (IIc only)
3S.40 On/Off Switch (IIe only)
3S.42 Power Supply Fuse (F871)

Note: For Series "H" Take-Apart, see the next section, beginning on page 3H.1.

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in this section.

❑ REAR COVER (IIc ColorMonitor only) – Series "S"

WARNING: *AppleColor Composite Monitors contain high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the* You Oughta Know *tab before you remove the back cover.* ***Failure to follow the safety rules could result in serious injury.***

Materials Required

Medium Phillips screwdriver
Jeweler's screwdriver
Needlenose pliers

Remove

1. Switch off the monitor, unplug the AC power cord, and disconnect the video cable from the back of the monitor.

2. Carefully place the monitor face down on a soft, protective surface.

3. Remove the five screws (Figure 1, #1) from the bottom of the monitor.

   Note: If antistatic rubber grommets are covering the bottom case screws, remove them using a jeweler's screwdriver or needlenose pliers.

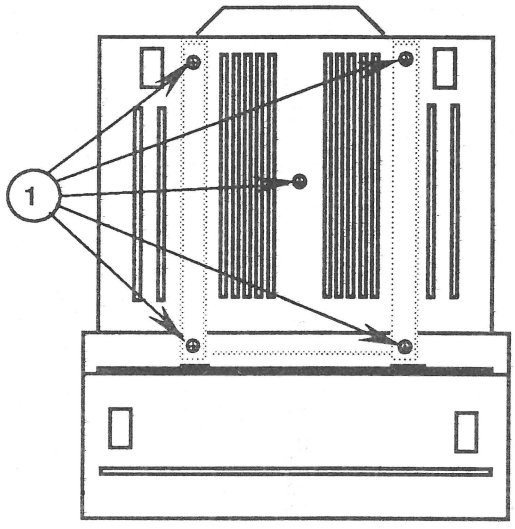


FIGURE 1

4. Remove the four screws (Figure 2, #1) from the back of the monitor.

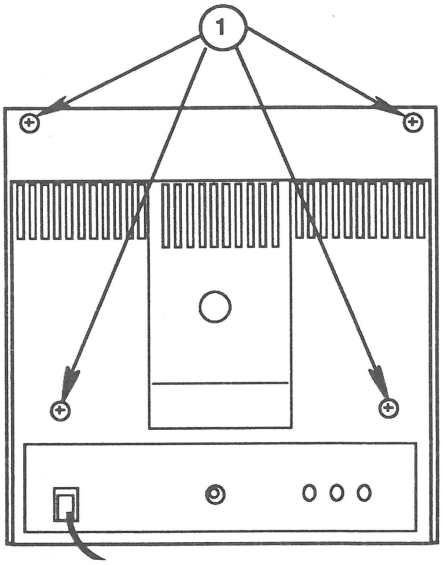


FIGURE 2

5. Carefully pull the rear cover up until it clears the CRT board (Figure 3, #1) at the end of the CRT neck.

CAUTION: *The rear cover cannot be completely removed until the power switch cable (Figure 3, #2) is disconnected from the power supply board, as directed in Step 7.*

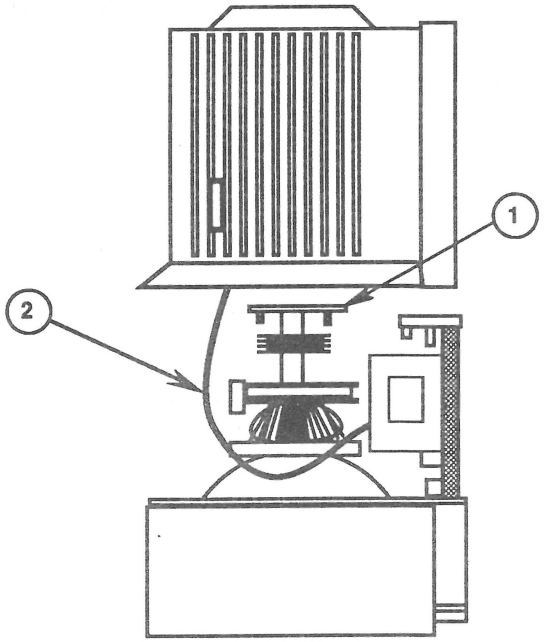


FIGURE 3

6. Place the rear cover next to the monitor.

7. Follow the power switch wire (Figure 4, #1) from the switch (inside the rear cover) to its connector on the power supply board. Disconnect the power switch connector from CN11 on the power supply board (Figure 4, #2).

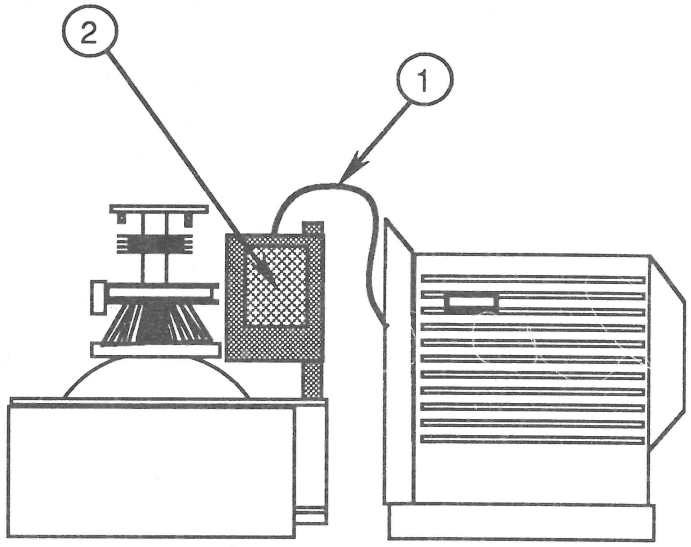


FIGURE 4

8. Pull the AC power cord through the opening in the rear cover. Set the rear cover aside.

Replace

1. Carefully set the monitor face-down on a soft, protective surface.

2. Connect the power switch cable (from inside the rear cover) to CN11 on the power supply board (Figure 4, #2).

3. Guide the AC power cord (Figure 5, #1) through the opening in the rear cover while you lower the rear cover onto the monitor.

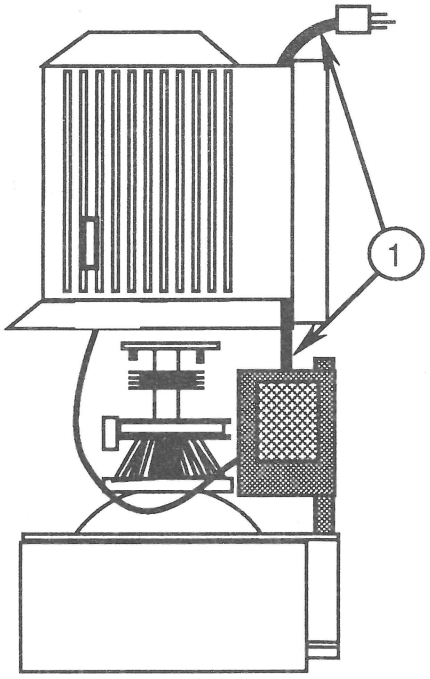


FIGURE 5

4. Replace the four screws (Figure 6, #1) on the back of the monitor.

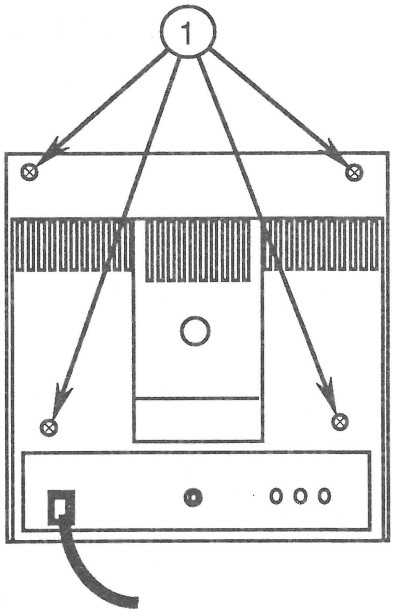


FIGURE 6

5. Replace the five screws (Figure 7, #1) at the bottom of the monitor.

   Note: If you removed antistatic rubber grommets from the bottom case screws, replace them by pushing the grommets firmly over the screw heads.

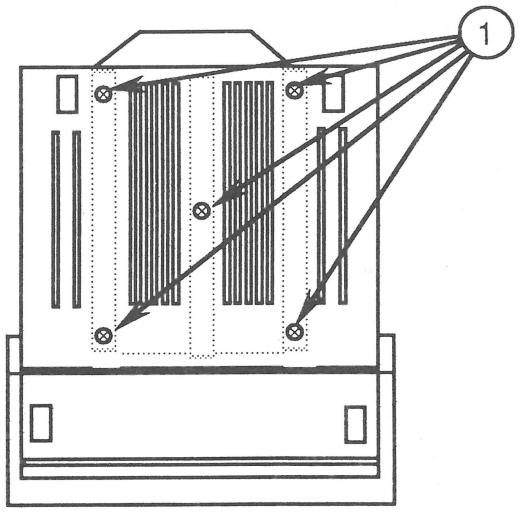


FIGURE 7

6. Carefully set the monitor upright.

❑ REAR COVER (IIe ColorMonitor only) – SERIES "S"

WARNING: *AppleColor Composite Monitors contain high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the* You Oughta Know *tab before you remove the back cover.* ***Failure to follow the safety rules could result in serious injury.***

Materials Required

Medium Phillips screwdriver

Remove

1. Switch off the monitor, unplug the AC power cord, and disconnect the video cable.

2. Carefully place the monitor face-down on a soft, protective surface.

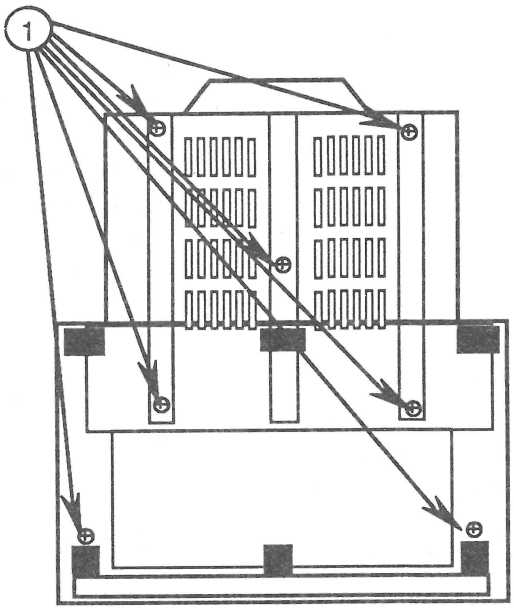


FIGURE 8

3. Remove the seven screws (Figure 8, #1) from the bottom of the monitor.

4. Remove the four screws (Figure 9, #1) from the back of the monitor.

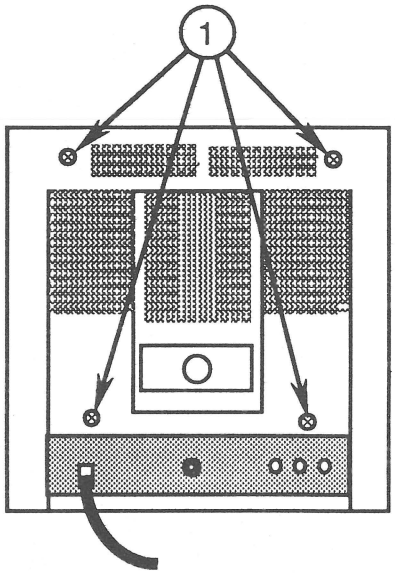


FIGURE 9

5. Carefully pull the rear cover up until it clears the CRT board (Figure 10, #1).

6. Pull the AC power cord (Figure 10, #2) through the opening in the rear cover. Set the rear cover aside.

7. Carefully set the monitor upright.

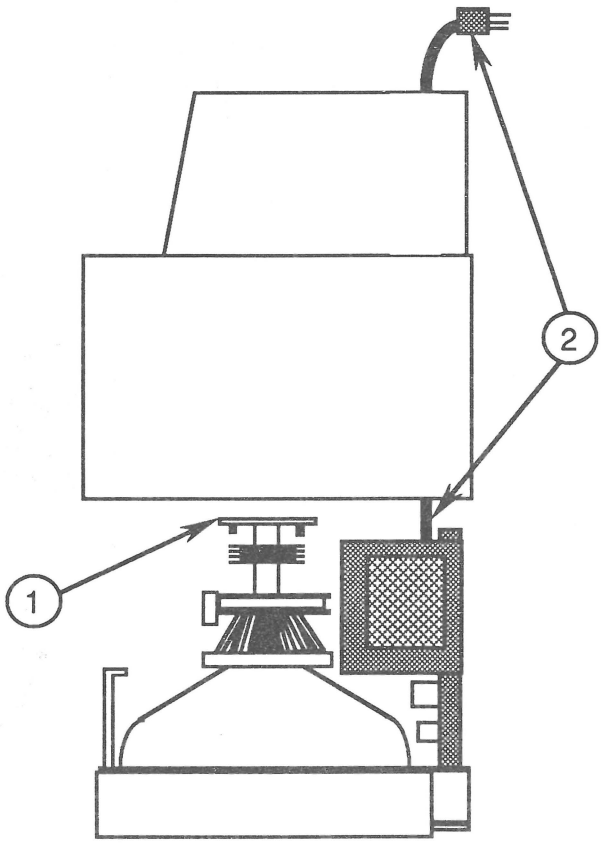


FIGURE 10

Replace

1. Carefully place the monitor face-down on a soft, protective surface.

2. Guide the AC power cord (Figure 10, #2) through the opening in the cover as you lower the cover onto the monitor.

3. Replace the four screws (Figure 11, #1) on the back of the monitor.

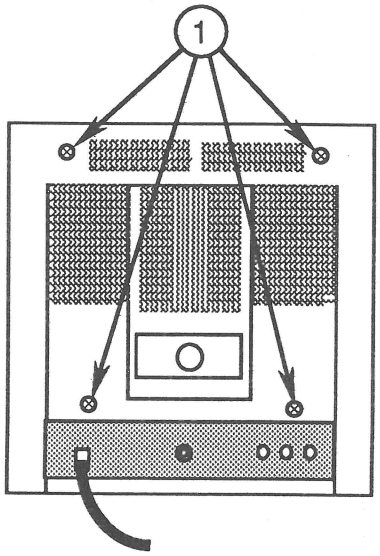


FIGURE 11

4. Replace the seven screws (Figure 12, #1) on the bottom of the monitor.

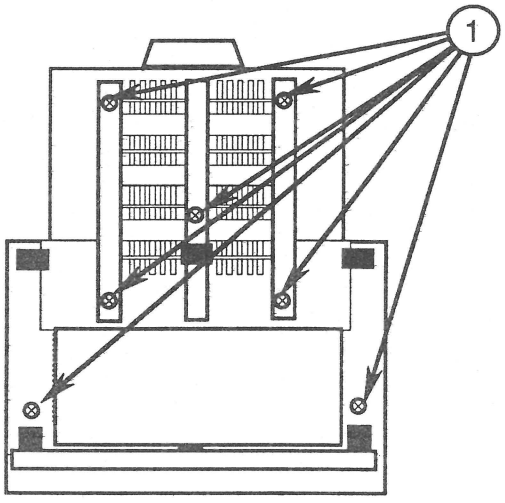


FIGURE 12

5. Carefully set the monitor upright.

❑ DISCHARGING THE CATHODE RAY-TUBE (CRT) – SERIES "S"

Materials Required

Safety goggles
Foam pad (ungrounded)
Needlenose pliers
Alligator lead
New CRT discharge tool (part number **076-0381**)

WARNING: Before starting, read the safety precautions and the CRT discharge procedure in Section 8, CRT Safety, under the* You Oughta Know *tab. *Alternative instructions for discharging the CRT using the older version of the discharge tool (and/or a screwdriver) are given in that section.*

Discharge Procedure

1. **Remove your grounding wriststrap and jewelry and put on safety goggles before beginning!**

WARNING: *To prevent serious injury, do not touch the yoke wires (Figure 13, #1), the anode wire (Figure 13, #2), the anode connector (Figure 13, #3), or the flyback transformer (Figure 13, #4).*

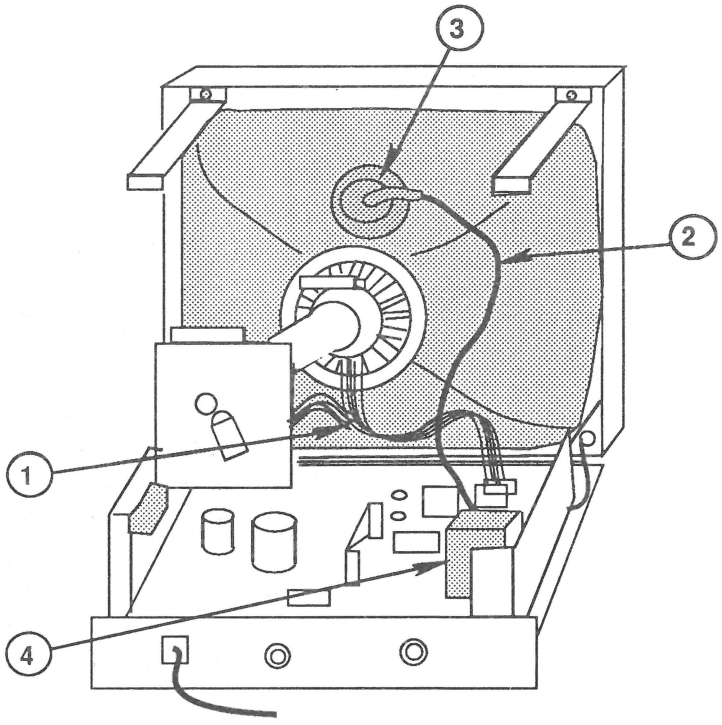


FIGURE 13

2. Remove the rear cover.

3. Set the monitor upright on the ungrounded foam pad, with the back facing you.

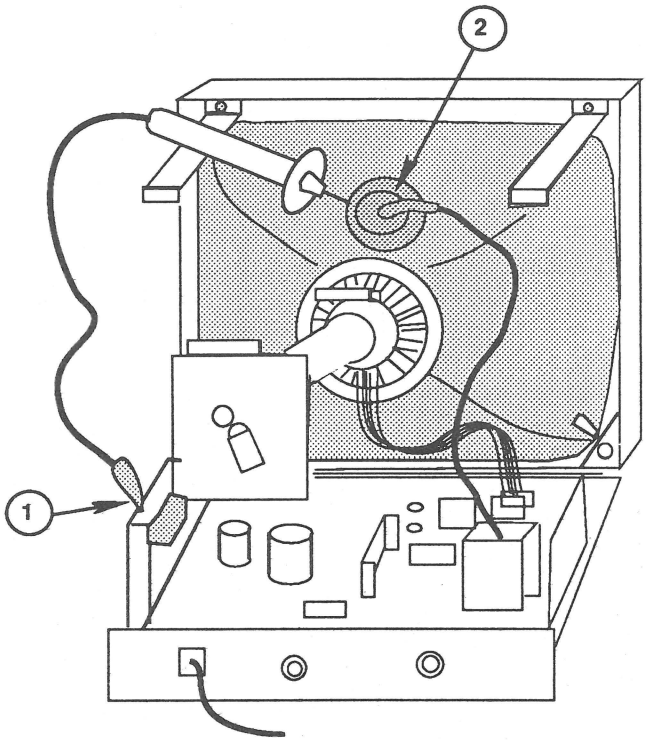


FIGURE 14

4. Attach the clip of the CRT discharge tool to any metal part of the chassis (Figure 14, #1).

5. Put one hand behind your back, and grasp the handle of the discharge tool with your other hand.

WARNING: *Use only one hand when discharging the CRT to prevent forming a path of current through your body should your hand slip and touch the metal part of the discharge tool during the discharge procedure.*

6. Hold the CRT discharge tool to the tube surface, and insert its probe under the anode cap (Figure 14, #2) until it touches the anode ring.

7. Remove the probe of the CRT discharge tool from under the anode cap and detach its clip from the metal chassis.

Note: A secondary charge could build up over time, even after you have discharged the CRT. To dissipate any residual charge, establish an ongoing ground by clipping one end of an alligator lead to the chassis frame and the other end to the anode ring or aperture.

Anode Cap

For some procedures, you may have to remove the anode cap. After you have discharged the CRT, peel back the anode cap until you can see the anode "ring" (or connector) at the center. Using needlenose pliers, compress the two prongs on the connector to free it from the anode aperture.

To replace the anode cap, press together the two prongs of the anode connector so that you can insert it into the aperture. Tug on the anode wire to make sure it is firmly seated, and then press down around the edges of the rubber anode cap to ensure a firm seal.

❑ MAIN LOGIC PCB – SERIES "S"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT, and remove the anode cap.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Locate the power supply board (Figure 15, #1).

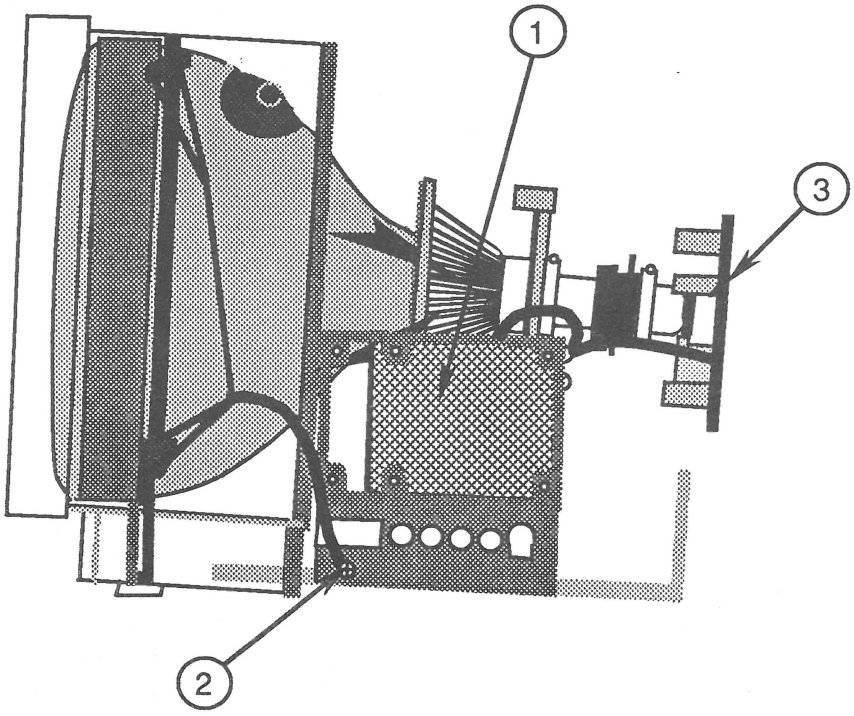


FIGURE 15

5. Disconnect connectors CN9, CN10, and CN11 from the power supply board.
6. Carefully set the monitor face-down on a soft, protective surface.

7. Remove the four screws (Figure 16, #1) located between the bottom of the metal frame and the plastic case.

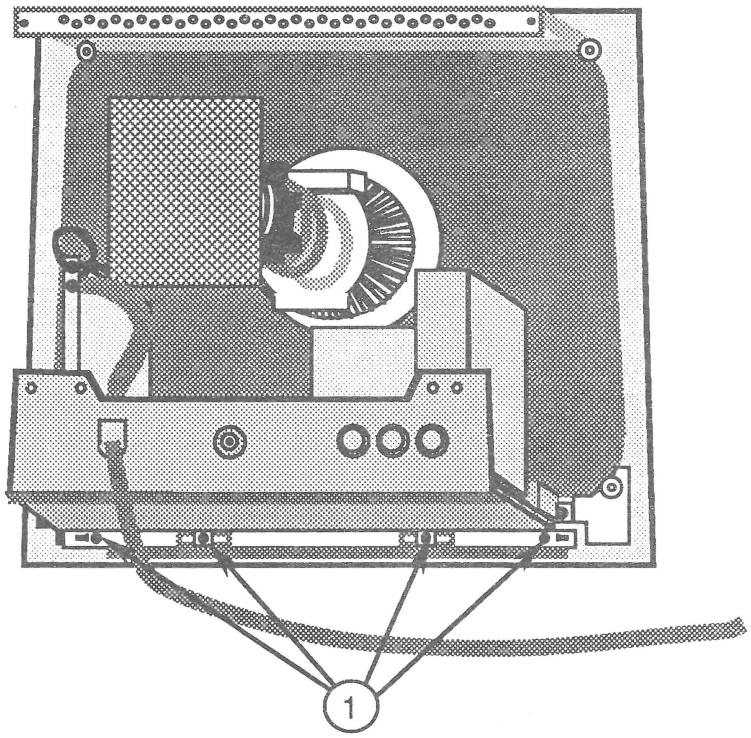


FIGURE 16

8. While supporting the main logic PCB with one hand, carefully tilt the monitor back until it is sitting upright.

9. Remove the screws (Figure 15, #2) that secure the green CRT ground straps to each side of the metal chassis frame. (There is one screw on each side.)

10. Carefully pull the CRT board (Figure 15, #3) off the CRT neck, and cut any cable ties binding the CRT board wires together.

11. Remove all wires from the plastic cable clamp at the right of the CRT neck, just above the flyback transformer.

    Note: Some versions of the monitor may not have the plastic cable clamp.

12. Turn the CRT board so that you can see the component side.

13. Disconnect the single-wire black connector CN16 (Figure 17, #1) from the CRT board.

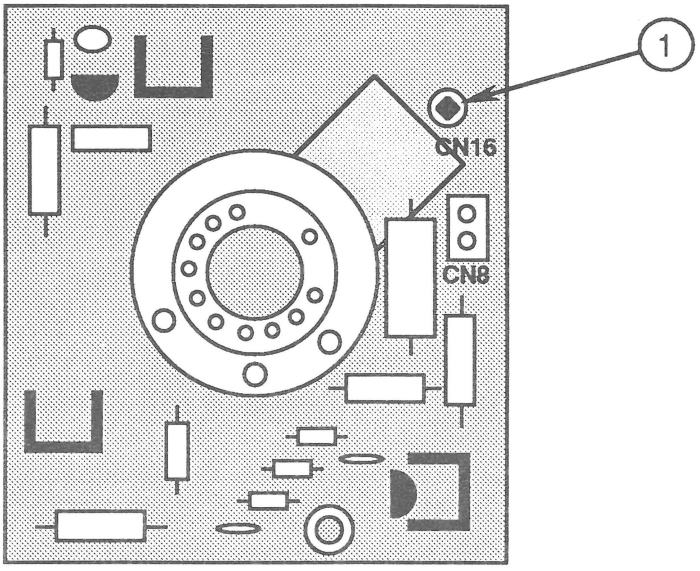


FIGURE 17

14. Carefully slide the main logic PCB out from under the CRT neck.

15. Disconnect the following connectors from the main logic PCB:

- CN4 – 7-wire connector from the control PCB at the front of the monitor (Figure 18, #1)
- CN5 – 2-wire connector from the white-only switch at the front of the monitor (Figure 18, #2)
- CN14 – 4-wire connector from the CRT board (Figure 18, #3)
- CN16 – 1-wire connector from the silver ground strap surrounding the CRT (Figure 18, #4)
- CN20 – 4-wire connector from the CRT neck (Figure 18, #5)

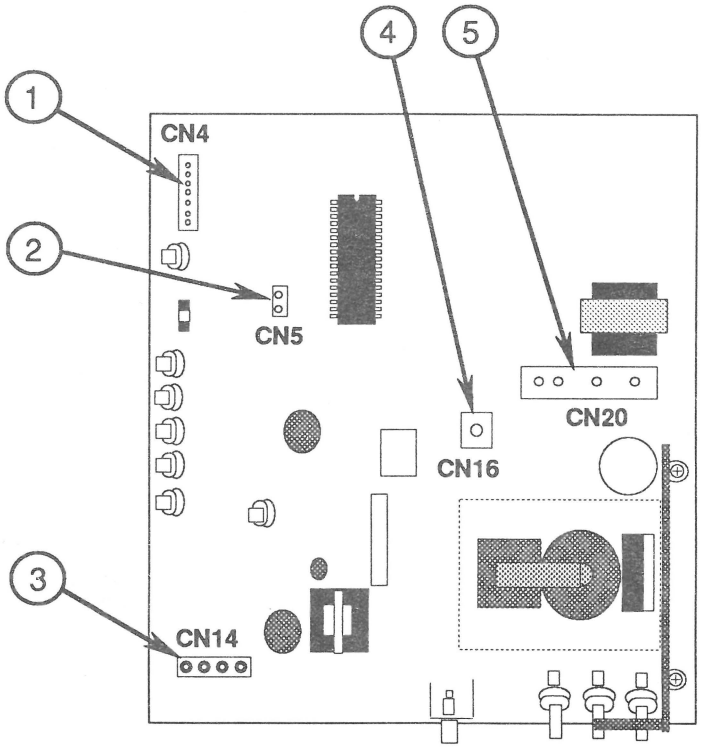


FIGURE 18

16. Move the main logic PCB (with power supply board) away from the CRT.

17. If you are removing the main logic PCB only to replace the CRT, the control PCB, or the white-only switch, leave the power supply/panel/AC cord assembly attached to the board.

18. If you are replacing the main logic PCB, follow the procedure below to remove the power supply/panel/AC cord assembly, the plastic control knobs, and the plastic standoff before sending the board back to Apple:

    a) Remove the two screws from the inside corners of the metal power supply bracket and the one remaining screw on the outside of the chassis frame (Figure 19, #1).

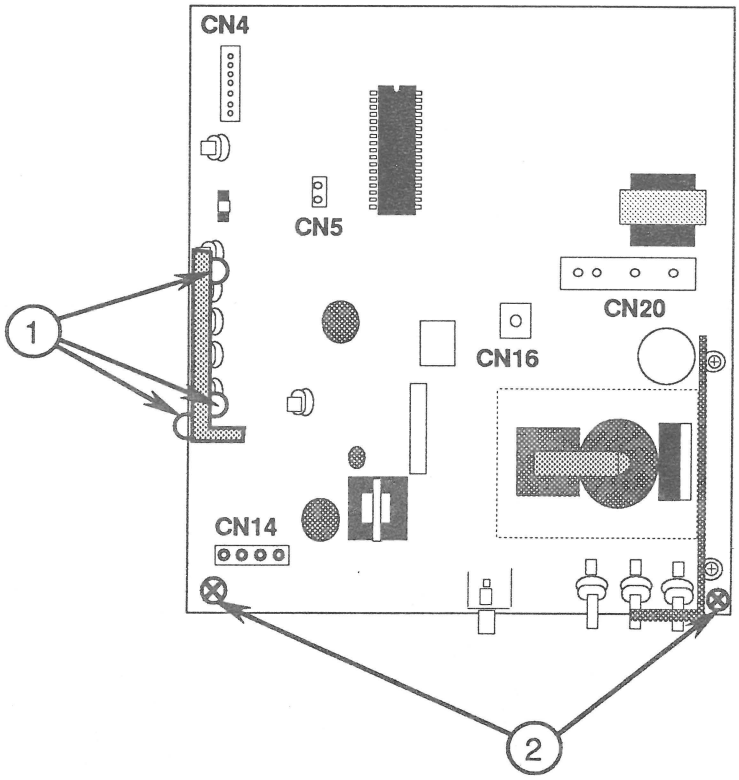


FIGURE 19

b) Lift the power supply board away from the main logic PCB and set the board to the side.

c) Remove the two screws (Figure 19, #2) from the rear corners of the main logic PCB.

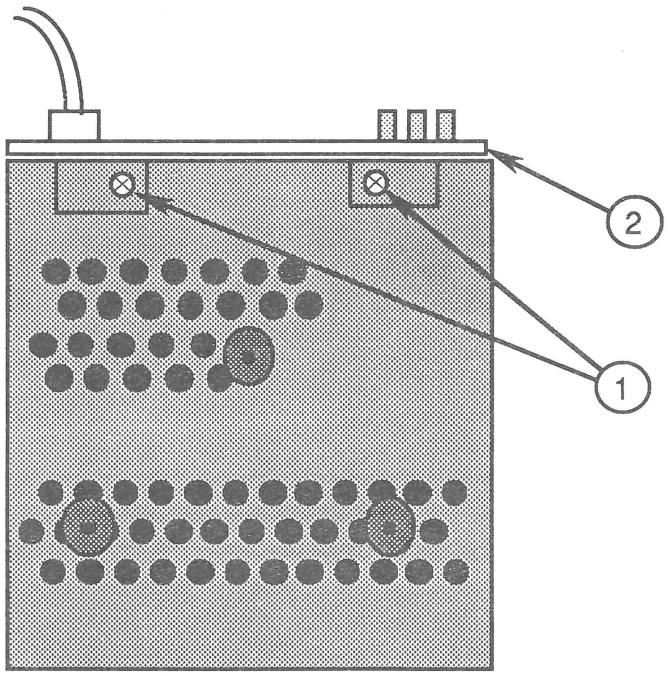


FIGURE 20

d) Turn the main logic PCB over, and remove the two screws (Figure 20, #1) from the bottom of the metal frame.

e) Pull the rear panel (Figure 20, #2), along with the AC cord and power supply board, away from the monitor.

f) Remove the three plastic control knobs at the rear of the main logic PCB. While holding the control knob mounting down with one hand, carefully pull each plastic knob off its shank.

CAUTION: *Be careful when removing the control knobs from the main logic PCB. Twisting or yanking on the knobs can damage the board.*

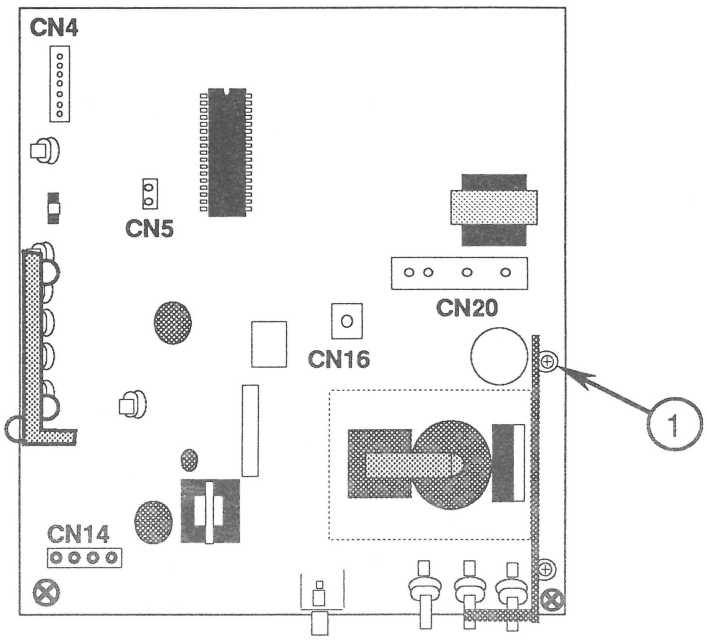


FIGURE 21

g) Remove the two screws (one from above, one from below) that hold the plastic standoff (Figure 21, #1) in place. Remove the plastic standoff.

h) Keep the following items to install on the replacement main logic PCB assembly:

- Power supply/panel/AC cord assembly
- Plastic control knobs
- Plastic standoff
- All screws

Replace

1. If you removed the main logic PCB to replace the CRT, the control PCB, or the white-only switch, proceed to step 3 of this procedure.

2. If you are installing a replacement main logic PCB, follow the procedure below to replace the plastic control knobs, the rubber standoff, and the power supply/panel/AC cord assembly:

   a) Replace the plastic standoff between the main logic PCB and the chassis frame.

   b) Install the two screws (one from above, one from below) that hold the rubber standoff in place (Figure 21, #1).

   c) Replace the three plastic control knobs at the rear of the main logic PCB.

   d) Place the rear panel over the three control knobs. The supports on the bottom edge of the plastic panel fit flush between the logic board and its metal chassis.

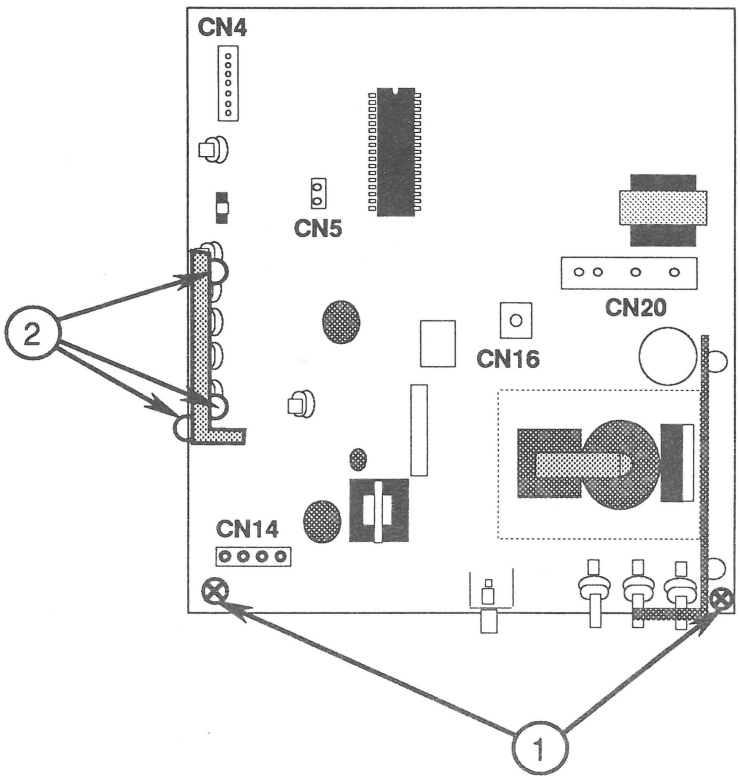


FIGURE 22

e) Replace the two screws (Figure 22, #1) at the rear corners of the main logic PCB.

f) Replace the two screws (Figure 23, #1) that secure the rear panel to the bottom of the metal chassis.

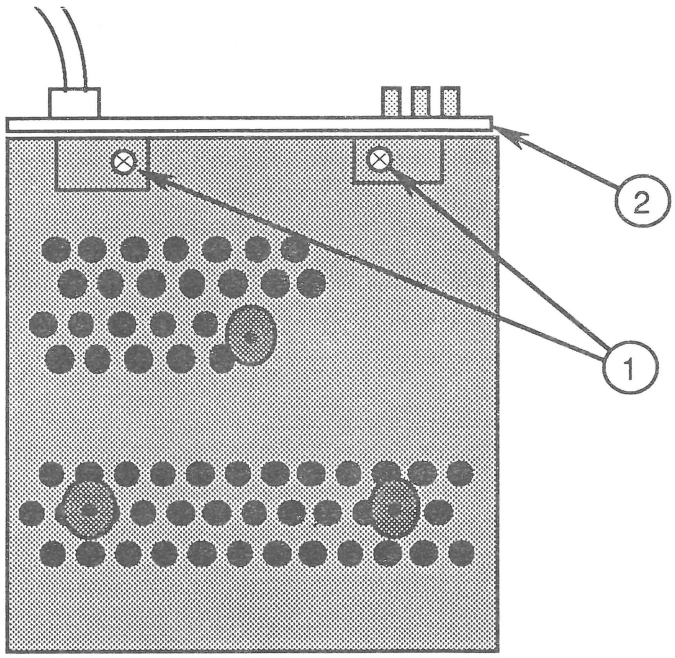


FIGURE 23

g) Replace the three mounting screws (Figure 22, #2) that secure the power supply board bracket to the chassis frame.

3. With the front bezel (with CRT) on its feet, slide the main logic PCB under the CRT neck about three inches away from the base of the CRT.

4. Reconnect the following connectors to the main logic PCB:

   - CN4 - 7-wire connector from the control PCB at the front of the monitor (Figure 24, #1)
   - CN5 – 2-wire connector from the white-only switch at the front of the monitor (Figure 24, #2)
   - CN14 – 4-wire connector from the CRT board (Figure 24, #3)
   - CN16 – 1-wire connector from the silver ground strap surrounding the CRT (Figure 24, #4)
   - CN20 – 4-wire connector from the CRT neck (Figure 24, #5)

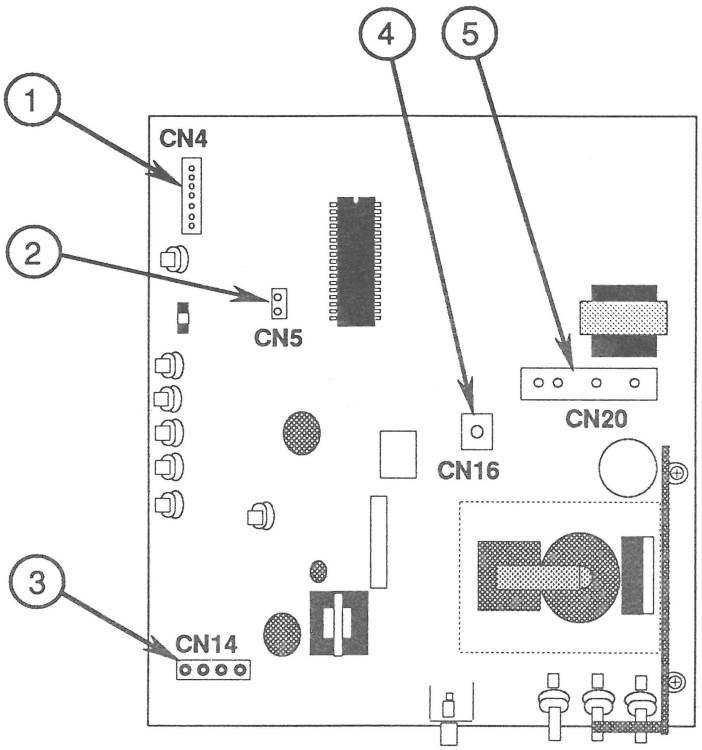


FIGURE 24

5. Reconnect the following connectors to the power supply board:

   - CN9 – (green, black, white) (Figure 25, #1)
   - CN10 – (white) (Figure 25, #2)
   - CN11 – (red) (Figure 25, #3)

   Note: If the monitor is a IIc, the cable to CN11 on the power supply board is attached to the inside of the rear cover. Set the rear cover next to the main logic PCB, and reconnect CN11 to the power supply board.

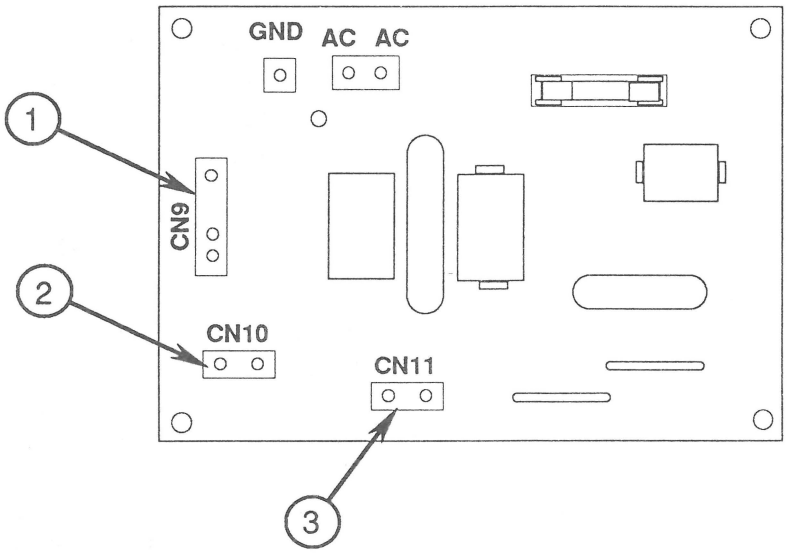


FIGURE 25

6. Slide the main logic PCB toward the front bezel as far as it will go.

7. Reconnect the black, single-wire connector to CN16 on the CRT board (Figure 26, #1). This connector is attached to the green CRT ground strap.

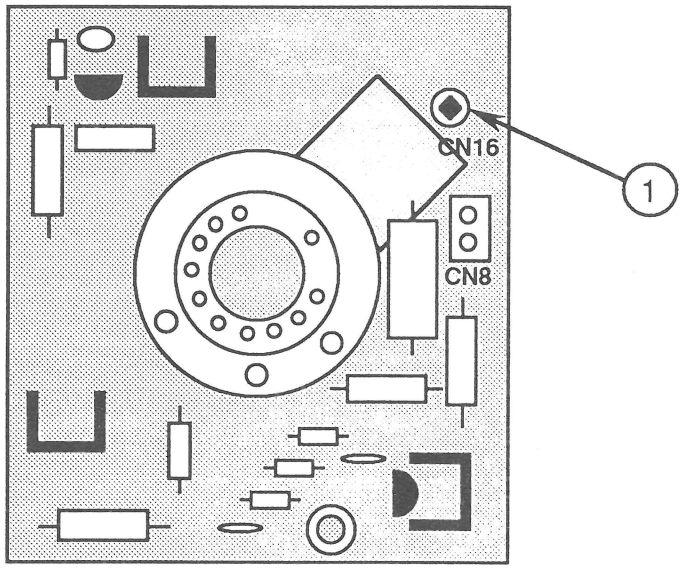


FIGURE 26

8. Replace the CRT board (Figure 27, #1). It fits only one way.

9. Replace the wires in the plastic cable clamp located just above the flyback transformer.

   Note: Some versions of the monitor may not have the plastic cable clamp.

10. Replace the screws (Figure 27, #2) that secure the CRT ground straps to both sides of the metal chassis frame.

11. While supporting the main logic PCB with one hand, gently set the monitor face-down on a soft, protective surface.

12. Replace the four main screws (Figure 28, #1) that secure the main logic PCB to the plastic monitor case.

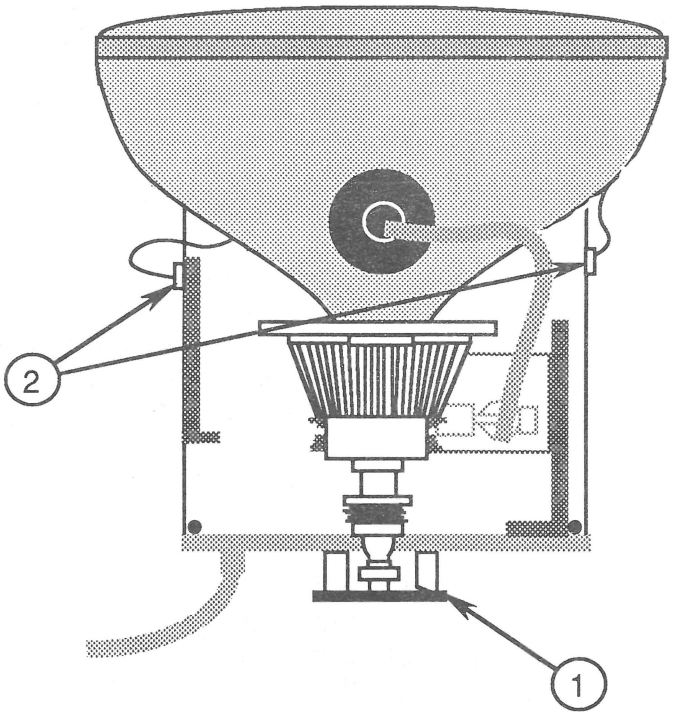


FIGURE 27

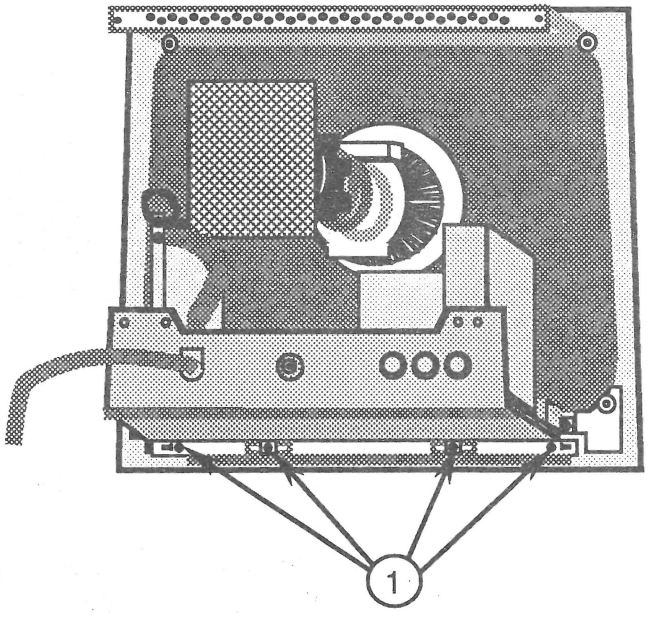


FIGURE 28

13. Replace the anode cap.

14. Replace the rear cover.

❑ POWER SUPPLY/PANEL/AC CORD ASSEMBLY – SERIES "S"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Locate the power supply board (Figure 29, #1).

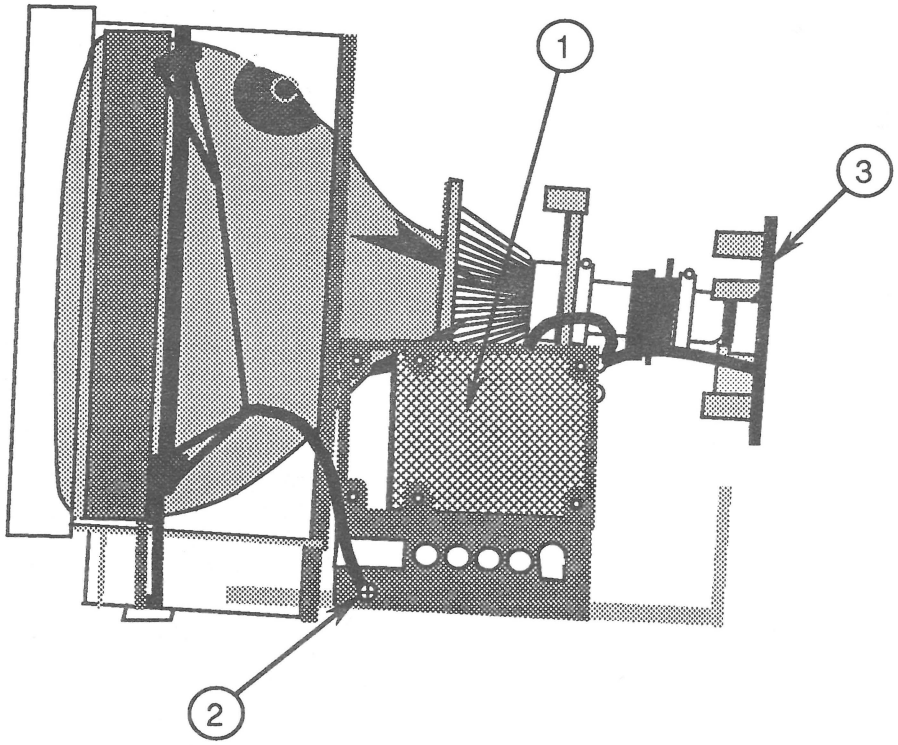


FIGURE 29

5. Disconnect connectors CN9, CN10, and CN11 from the power supply board.

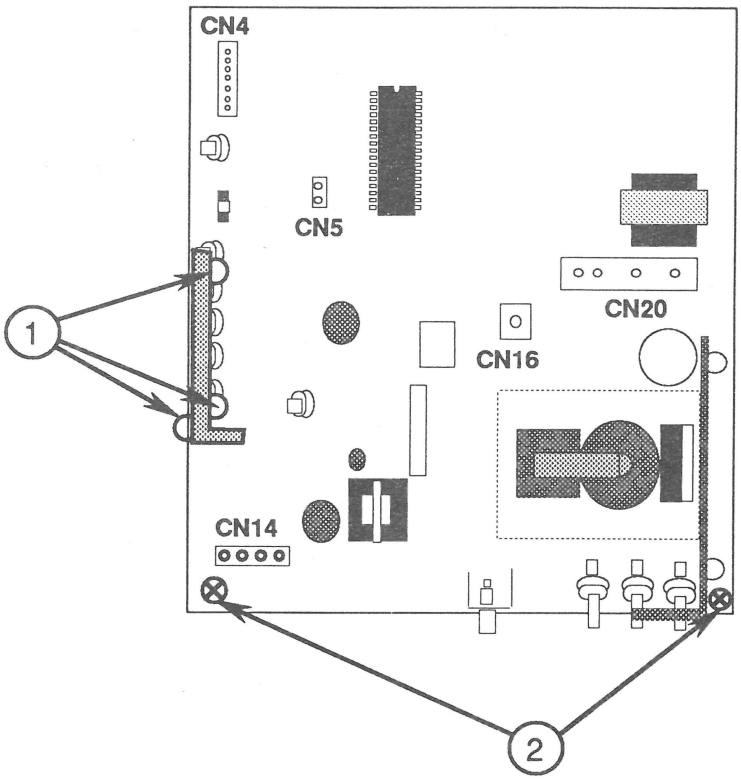


FIGURE 30

6. Remove the two mounting screws from the inside corners of the power supply board and the one remaining mounting screw on the outside corner (Figure 30, #1).

7. Remove the two screws (Figure 30, #2) from the rear corners of the main logic PCB.

8. Turn the main logic PCB over, and remove the two screws (Figure 31, #1) from the bottom of the metal frame.

9. Pull the rear panel (Figure 31, #2), along with the AC cord and power supply board, away from the monitor.

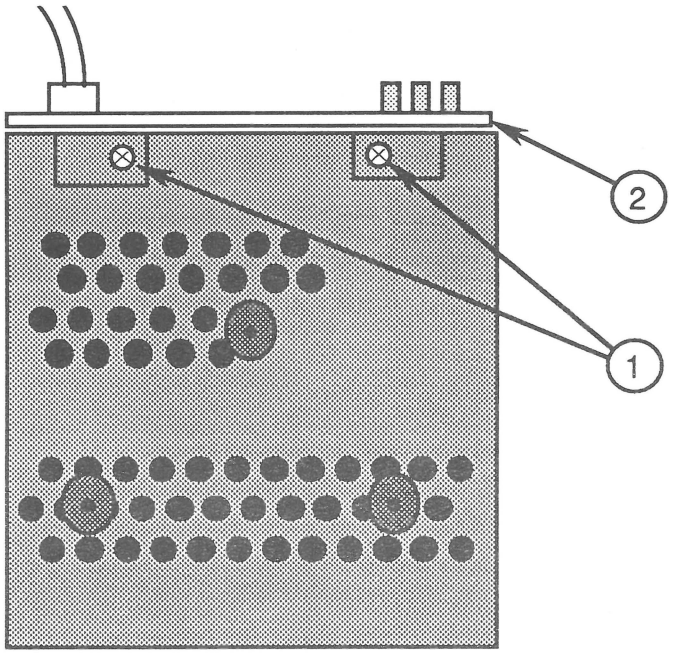


FIGURE 31

Replace

1. Place the rear panel over the three controls at the back of the main logic PCB. The supports on the bottom edge of the plastic panel fit flush between the logic board and its metal chassis.

2. Replace the two screws (Figure 32, #1) at the rear corners of the main logic PCB.

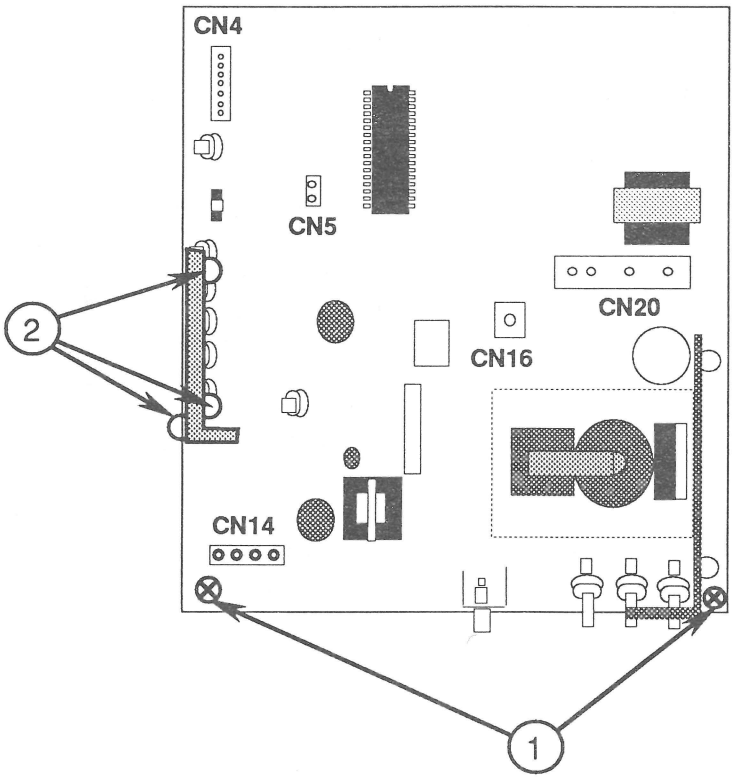


FIGURE 32

3. Replace the two screws (Figure 31, #1) to secure the rear panel to the bottom of the metal chassis.

4. Replace the three mounting screws (Figure 32, #2) that secure the power supply board bracket to the logic board frame.

5. Replace the rear cover.

❑ CATHODE-RAY TUBE (CRT) – SERIES "S"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT, and remove the anode cap.
3. Remove the main logic PCB.
4. Carefully place the monitor face-down on a soft, protective pad.
5. Locate the degaussing coil (Figure 33, #1). It is braced to the CRT by plastic-coated holding tabs at each corner.

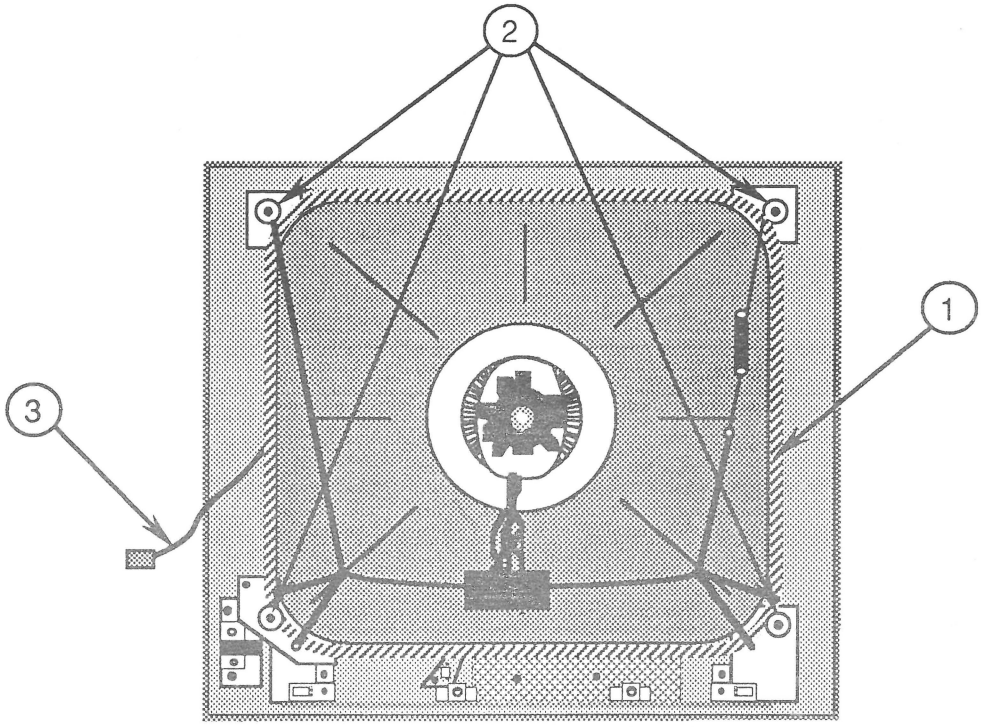


FIGURE 33

6. Bend the tabs out to free the degaussing coil. Lift the coil away from the CRT.

7. Remove the four sets of CRT mounting screws, case support brackets, washers, and holding tabs (Figure 33, #2).

8. Carefully lift the CRT out of the front bezel.

WARNING: *If you intend to dispose of the CRT, refer to "Disposing of the Cathode-Ray Tube" in Section 8, CRT Safety, under the* You Oughta Know *tab.*

Replace

1. Place the front bezel face-down on a soft, protective pad.

2. Carefully set the CRT inside the bezel (see Figure 33).

3. Replace the holding tabs, washers, case support brackets, and CRT mounting screws (Figure 33, #2).

4. Place the degaussing coil over the CRT so that the connector (Figure 33, #3) is at the left side when you face the back of the monitor.

5. Bend the holding tab stems around the degaussing coil to secure the coil to the CRT.

6. Replace the main logic PCB.

7. Replace the anode cap.

8. Replace the rear cover.

❑ CONTROL PCB – SERIES "S"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT and remove the anode cap.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Remove the main logic PCB.
5. Place the monitor face-down on a soft, protective surface.
6. Locate the control PCB (Figure 34, #1).
7. Remove the two mounting screws (Figure 34, #2).
8. Lift the control PCB just high enough to turn it over to the component side.

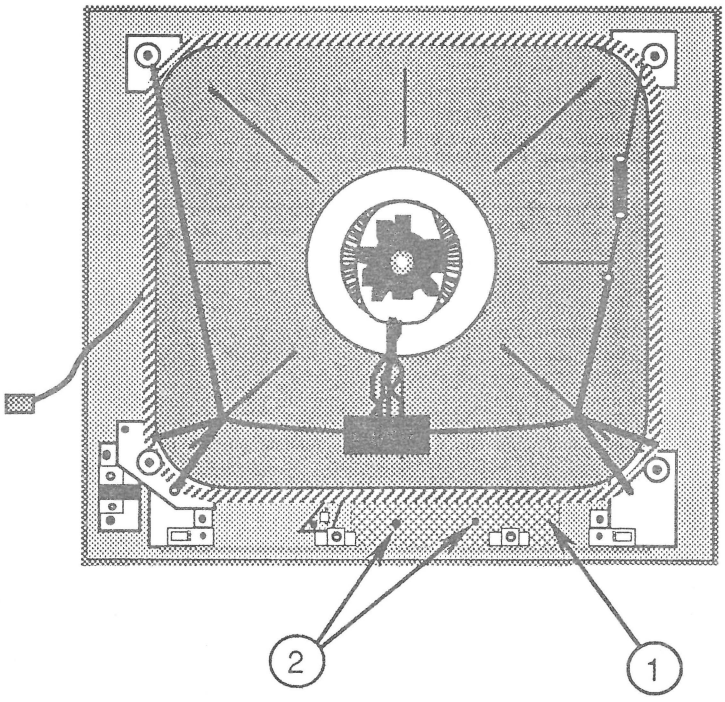


FIGURE 34

9. Disconnect the LED connector CN15 from the control PCB. (This connector must be detached before you can completely remove the control PCB.)

10. Remove the control PCB from the front bezel.

11. Remove the four plastic control knobs from the control PCB. While using one hand to hold the control knob mounting down, carefully pull each plastic knob off its shank. Keep the control knobs to install on the replacement control PCB.

CAUTION: *Be careful when removing the control knobs from the main logic PCB. Twisting or yanking on the knobs can damage the board.*

Replace

1. Replace the four plastic control knobs on the control PCB.

2. Reconnect connector CN15 to the control PCB.

3. Lower the control PCB into the bezel so that the control knobs protrude through the holes on the front panel (they fit only one way). The control PCB 7-wire connector should extend to the left as you face the back of the monitor.

4. Replace the two mounting screws (Figure 34, #2).

5. Replace the main logic PCB.

6. Replace the anode cap.

7. Replace the rear cover.

❑ WHITE-ONLY SWITCH – SERIES "S"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT and remove the anode cap.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Remove the main logic PCB.
5. Place the monitor face-down on a soft, protective surface.
6. Locate the white-only switch (Figure 35, #1).
7. Remove the two screws (Figure 35, #2) that secure the switch plate to the front bezel, and remove the white-only switch.
8. Remove the plastic control knob from the white-only switch. Hold the control switch mounting down with one hand, and carefully pull the knob off its shank. Keep the knob to use on the replacement switch.

CAUTION: *Be careful when removing the control knob from the white-only switch. The knob mounting is flexible and can be easily broken, requiring replacement of the whole switch.*

Replace

1. Install the customer's plastic knob over the switch shank.
2. Place the switch into the front bezel so that the plastic post protrudes through the hole in the switch plate (Figure 35, #1).

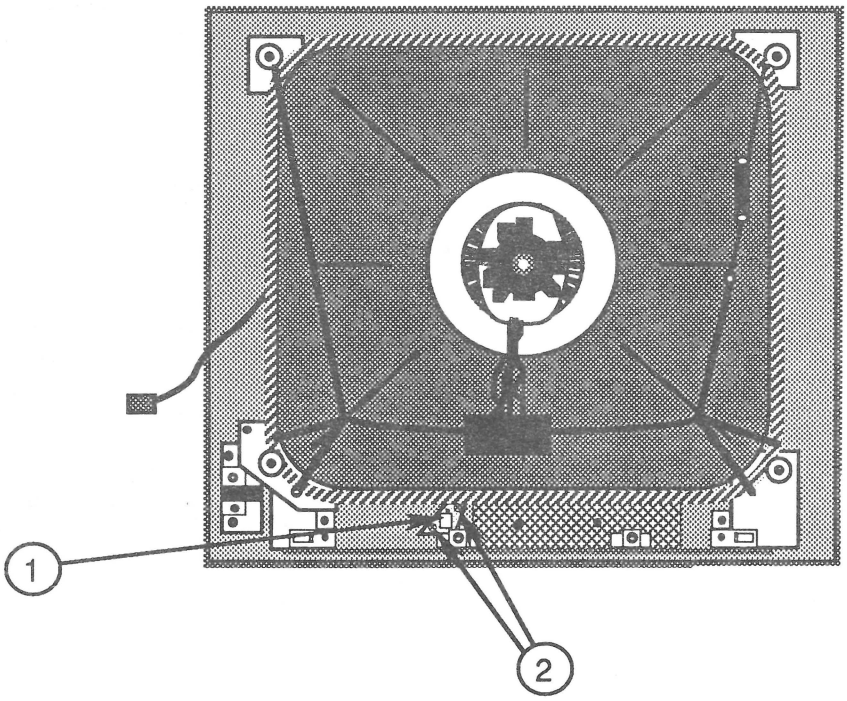


FIGURE 35

3. Replace the two mounting screws (Figure 35, #2).
4. Replace the main logic PCB.
5. Replace the anode cap.
6. Replace the rear cover.

❑ ON/OFF SWITCH (IIc ColorMonitor only) – SERIES "S"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Locate the on/off switch (Figure 36, #1) inside the rear cover. It is mounted on a plastic bracket attached to the side of the rear cover.

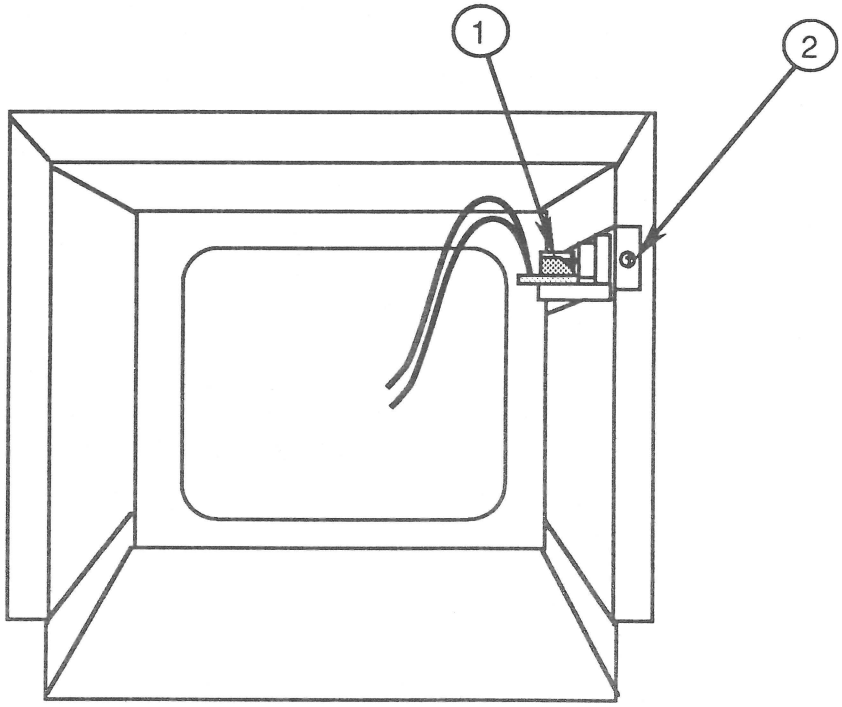


FIGURE 36

CAUTION: *Make sure the on/off switch is disconnected from the power supply board.*

5. Remove the screw (Figure 36, #2) that secures the plastic bracket to the rear cover.
6. Pull the switch button (Figure 37, #1) off its shaft.

7. Remove the two screws (Figure 37, #2) that secure the on/off switch to the plastic bracket.

Replace

1. Replace the two mounting screws (Figure 37, #2) that secure the on/off switch to its bracket.

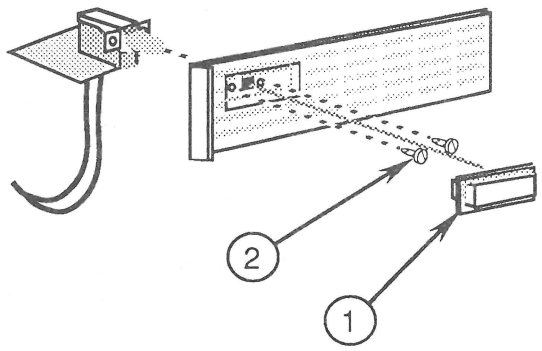


FIGURE 37

2. Snap the switch button (Figure 37, #1) onto the switch shaft.

3. Replace the screw (Figure 36, #2) that secures the bracket to the inside of the rear cover.

4. Replace the rear cover.

❑ ON/OFF SWITCH (IIe ColorMonitor only) – SERIES "S"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT, and remove the anode cap.
3. Place the monitor on a grounded workbench pad and put on your grounding wriststrap. (Never do this step until after the CRT has been discharged.)
4. Remove the main logic PCB.
5. Remove the CRT.
6. Remove the screw (Figure 38, #1) holding the LED board to the bezel. Lift out the LED.

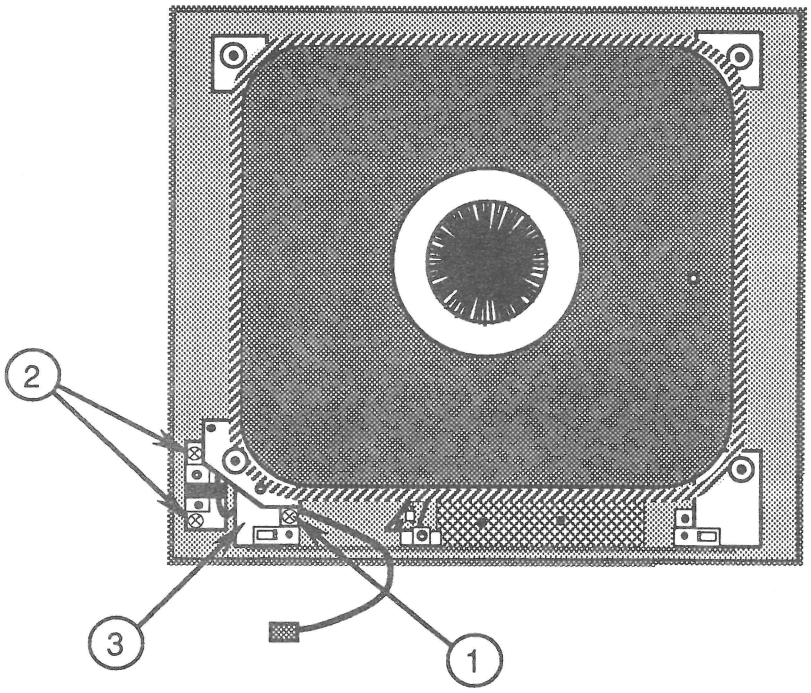


FIGURE 38

7. Remove the two screws (Figure 38, #2) that secure the on/off switch to the bezel. Lift the on/off switch out.

8. Pull the on/off switch connector wire under the CRT mounting bracket (Figure 38, #3) to free the switch assembly.

9. Pull the plastic switch button (Figure 39, #1) off the switch assembly, and remove the two screws (Figure 39, #2) that hold the switch to the metal bracket.

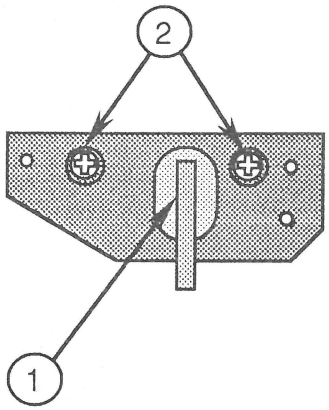


FIGURE 39

Replace

1. Replace the two screws (Figure 39, #2) that secure the on/off switch to the metal bracket.

2. Replace the plastic switch button (Figure 39, #1) over the switch shaft.

3. Slide the on/off switch connector wire under the CRT mounting bracket (Figure 38, #3) and pull the wire until the switch meets its slot in the front bezel.

4. Replace the two screws (Figure 38, #2) that secure the on/off switch to the bezel.

5. Place the LED board in position in the front bezel, and replace the single screw (Figure 38, #1).

6. Replace the CRT.

7. Replace the main logic PCB, and replace the anode cap.

8. Replace the rear cover.

❑ POWER SUPPLY FUSE (F871) – SERIES "S"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT.
3. Locate the power supply board (Figure 40, #1).
4. Locate fuse F871 (Figure 41, #1) on the component side of the power supply board.

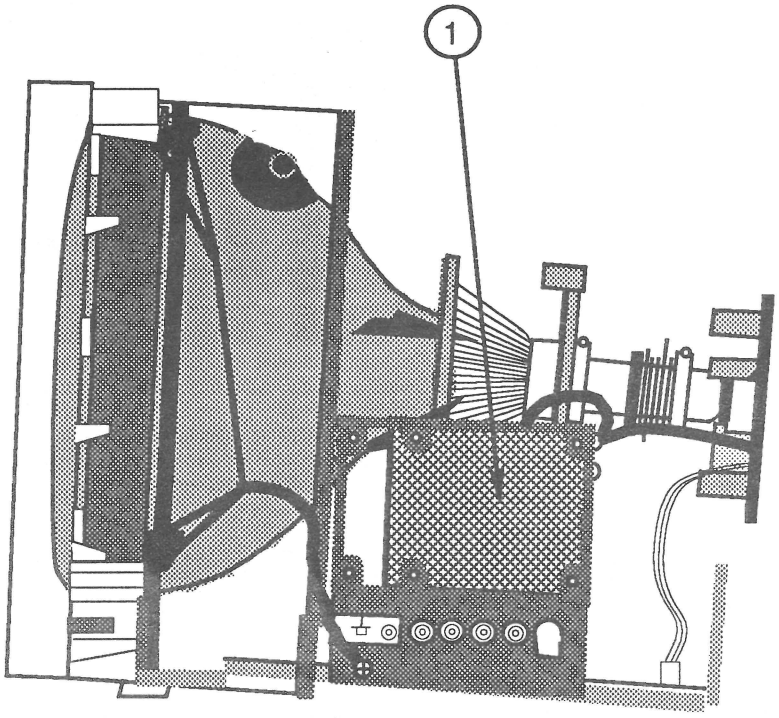


FIGURE 40

5. Gently pry up one end of the fuse with your fingers or a flat-blade screwdriver and lift out the fuse.

CAUTION: *Do not try to slide the fuse sideways. You may break the fuse holder.*

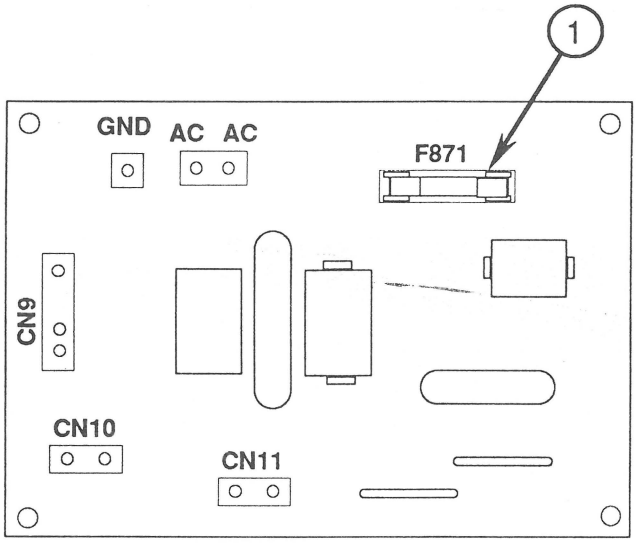


FIGURE 41

Replace

1. Carefully snap a new 250V 3A Slow Blow fuse into the fuse holder.

2. Replace the rear cover.

Apple Technical Procedures

Apple ColorMonitor IIe/IIc

Section 3 – Take-Apart Series "H"

❑ CONTENTS

3H.2 Rear Cover (IIc only)
3H.6 Rear Cover (IIe only)
3H.10 Discharging the Cathode-Ray Tube (CRT)
3H.10 Discharge Procedure
3H.11 Anode Cap
3H.12 Main Logic PCB (Rev. A only)
3H.28 Main Logic PCB (Rev. B only)
3H.42 Cathode-Ray Tube (CRT) (IIe only)
3H.44 Cathode-Ray Tube (CRT) (IIc only)
3H.46 LED Assembly (IIe only)
3H.48 LED Assembly (IIc only)
3H.49 Logic Board Fuses (F901 and F902)

Note: For Series "S" Take-Apart, see the preceding section, beginning on page 3S.1.

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in this section.

❑ REAR COVER (IIc ColorMonitor only) – SERIES "H"

WARNING: *AppleColor Composite Monitors contain high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the* You Oughta Know *tab before you remove the rear cover.* ***Failure to follow the safety rules could result in serious injury.***

Materials Required

Medium Phillips screwdriver

Remove

1. Switch off the monitor, unplug the AC power cord, and disconnect the video cable from the monitor.
2. Carefully set the monitor face-down on a soft surface.
3. Remove the two screws (Figure 1, #1) from the bottom of the monitor.

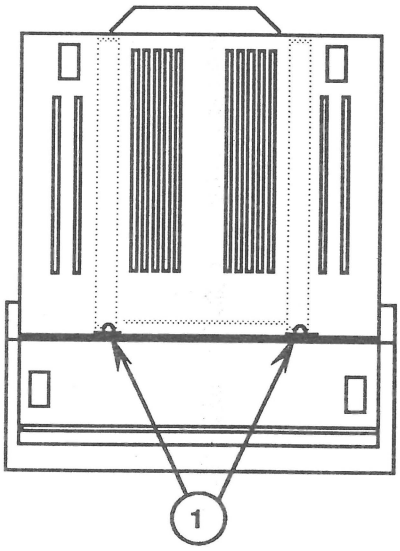


FIGURE 1

4. Remove the four screws (Figure 2, #1) from the back of the monitor.
5. Carefully pull the rear cover up until it clears the CRT socket board (Figure 3, #1) at the end of the CRT neck.

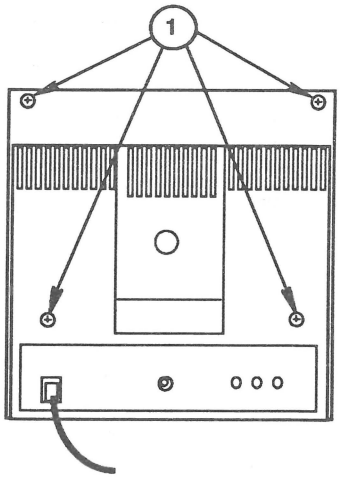


FIGURE 2

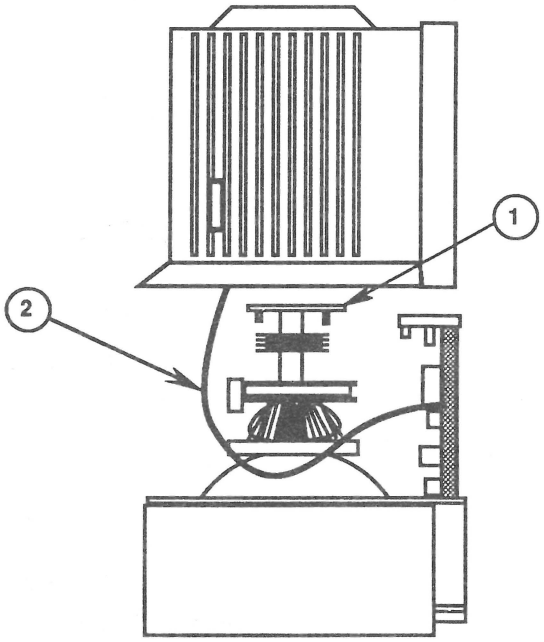


FIGURE 3

CAUTION: *Because the power (on/off) switch is attached to the rear cover, the power switch cable (Figure 3, #2) will prevent you from removing the cover completely until the on/off switch bracket is disconnected from the rear cover, as directed in step 8.*

6. Set the rear cover next to the monitor.

7. Locate the on/off switch inside the rear cover (see Figure 4). The switch is mounted on a plastic bracket that is attached to the side of the rear cover.

8. Remove the screw (Figure 4, #1) that secures the plastic on/off switch bracket to the rear cover.

9. Pull the AC power cord through the opening in the rear cover. Set the rear cover aside.

10. Carefully set the monitor upright.

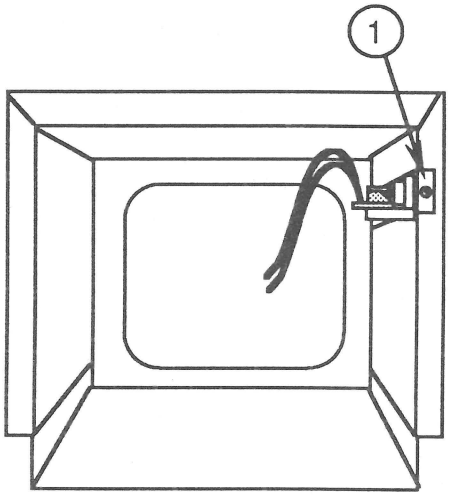


FIGURE 4

Replace

1. Replace the screw that holds the on/off switch bracket to the rear cover (Figure 4, #1).

2. Carefully set the monitor face down, on a soft, protective surface.

3. Guide the AC power cord (Figure 5, #1) through the opening in the rear cover while you lower the cover onto the monitor.

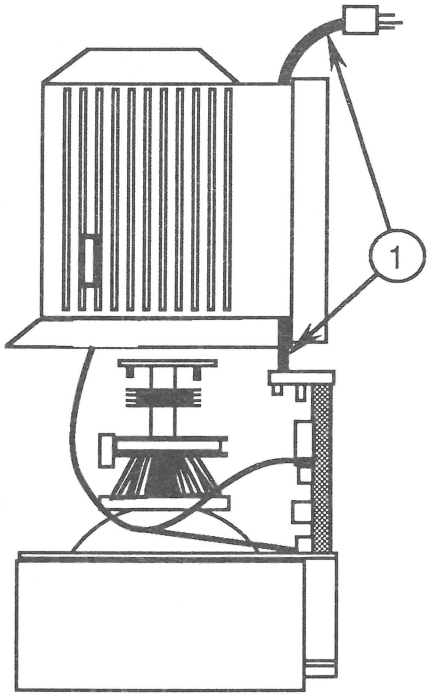


FIGURE 5

4. Replace the four screws (Figure 6, #1) on the back of the monitor.

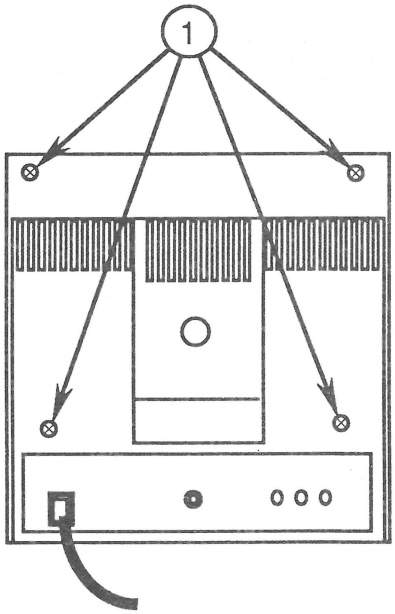


FIGURE 6

5. Replace the two screws (Figure 7, #1) at the bottom of the monitor.

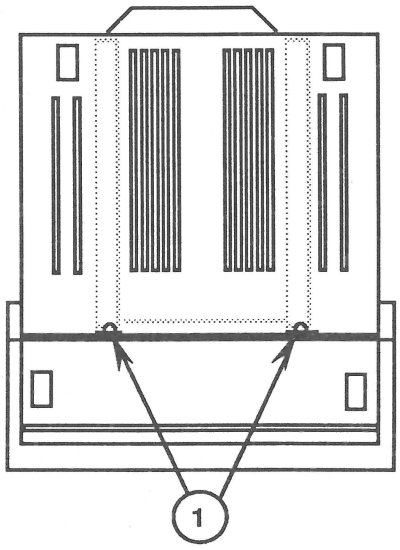


FIGURE 7

6. Carefully set the monitor upright.

❑ REAR COVER (IIe ColorMonitor only) – SERIES "H"

WARNING: *AppleColor Composite Monitors contain high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the* You Oughta Know *tab before you remove the rear cover.* ***Failure to follow the safety rules could result in serious injury.***

Materials Required

Medium Phillips screwdriver

Remove

1. Switch off the monitor, unplug the AC power cord, and disconnect the video cable.

2. Carefully place the monitor face down on a soft, protective surface.

3. Remove the two screws (Figure 8, #1) from the bottom of the monitor.

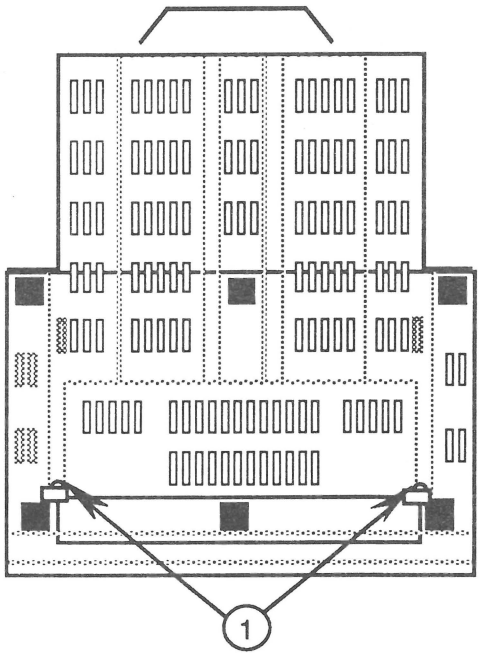


FIGURE 8

4. Remove the four screws (Figure 9, #1) from the back of the monitor.

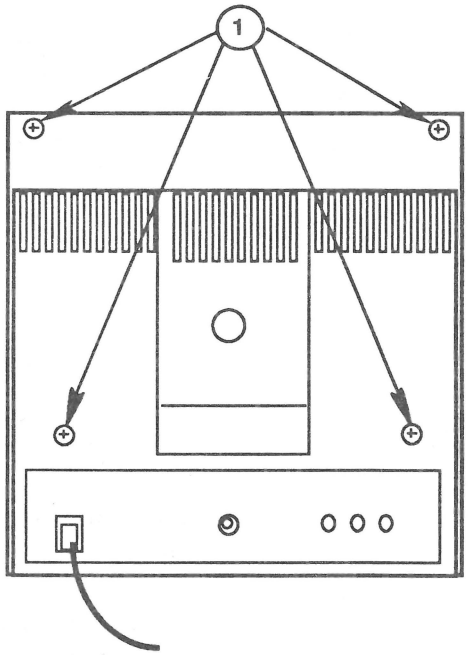


FIGURE 9

5. While pushing down on the rear panel with one hand, carefully pull the rear cover up until it clears the CRT board (Figure 10, #1).

6. Pull the AC power cord (Figure 10, #2) through the opening in the rear cover. Set the rear cover aside.

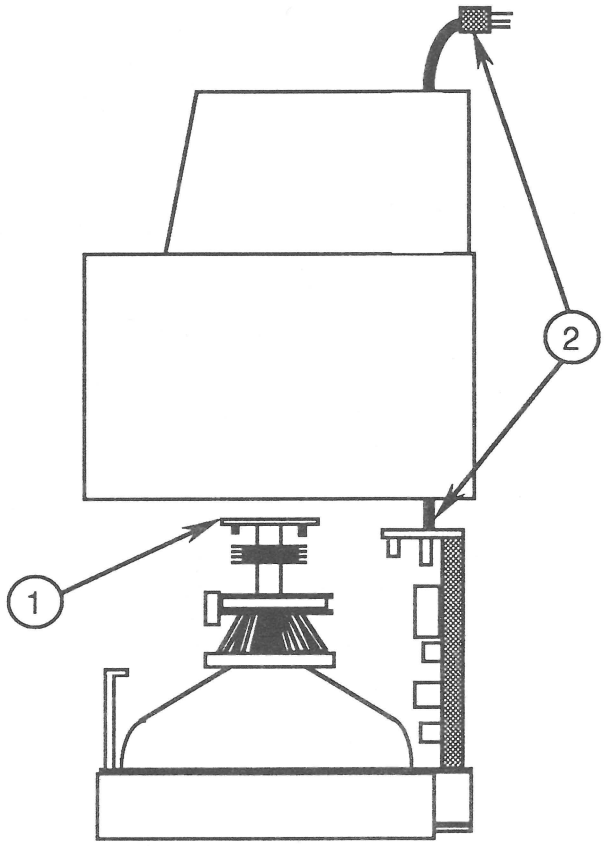


FIGURE 10

7. Carefully set the monitor upright.

Replace

1. Carefully place the monitor face down on a soft, protective surface.

2. Guide the AC power cord (Figure 10, #2) through the opening in the cover as you lower the cover onto the monitor.

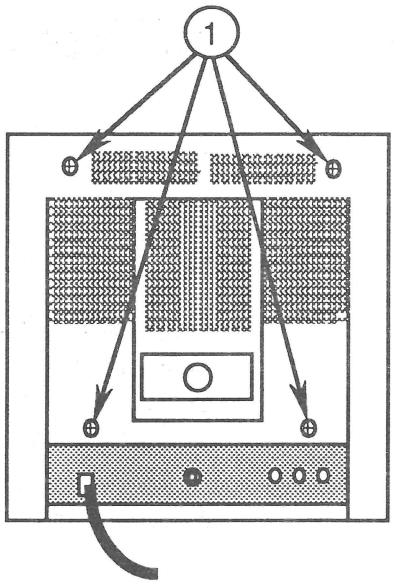


FIGURE 11

3. Replace the four screws (Figure 11, #1) on the back of the monitor.

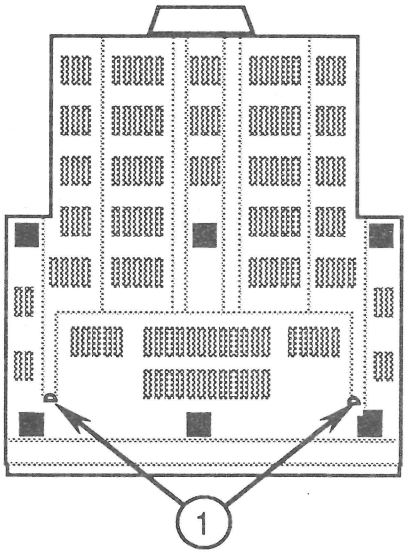


FIGURE 12

4. Replace the two screws (Figure 12, #1) on the bottom of the monitor.

5. Carefully set the monitor upright.

❑ DISCHARGING THE CATHODE-RAY TUBE (CRT) – SERIES "H"

Materials Required

Safety goggles
Foam pad (ungrounded)
Needlenose pliers
Alligator lead
New CRT discharge tool (part number **076-0381**)

WARNING: Before starting, read the safety precautions and the CRT discharge procedure in Section 8, CRT Safety, under the* You Oughta Know *tab. *Alternative instructions for discharging the CRT using the older version of the discharge tool (and/or a screwdriver) are given in that section.*

Discharge Procedure

1. **Remove your grounding wriststrap and jewelry and put on safety goggles before beginning!**
2. Remove the rear cover.
3. Set the monitor upright on the ungrounded foam pad, with the back facing you.

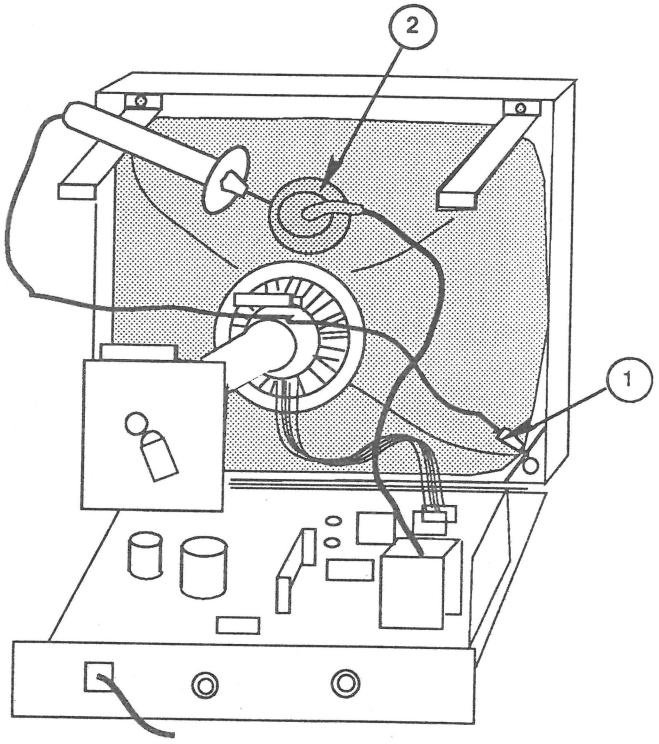


FIGURE 13

4. Attach the clip of the CRT discharge tool to any metal part of the chassis (Figure 13, #1).

5. Put one hand behind your back, and grasp the handle of the discharge tool with your other hand.

WARNING: *Use only one hand when discharging the CRT to prevent forming a path of current through your body should your hand slip and touch the metal part of the discharge tool during the discharge procedure.*

6. Hold the CRT discharge tool to the tube surface, and insert its probe under the anode cap (Figure 13, #2) until it touches the anode ring.

7. Remove the probe of the CRT discharge tool from under the anode cap and detach its clip from the metal chassis.

Note: A secondary charge could build up over time, even after you have discharged the CRT. To dissipate any residual charge, establish an ongoing ground by clipping one end of an alligator lead to the chassis frame and the other end to the anode ring or aperture.

Anode Cap

For some procedures, you may have to remove the anode cap. After you have discharged the CRT, peel back the anode cap until you can see the anode "ring" (or connector) at the center. Using needlenose pliers, compress the two prongs on the connector to free it from the anode aperture.

To replace the anode cap, press together the two prongs of the anode connector so that you can insert it into the aperture. Tug on the anode wire to make sure it is firmly seated, and then press down around the edges of the rubber anode cap to ensure a firm seal.

❑ MAIN LOGIC PCB (Rev. A only) – SERIES "H"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT, and remove the anode cap.
3. Remove all wires from the two plastic cable clamps.

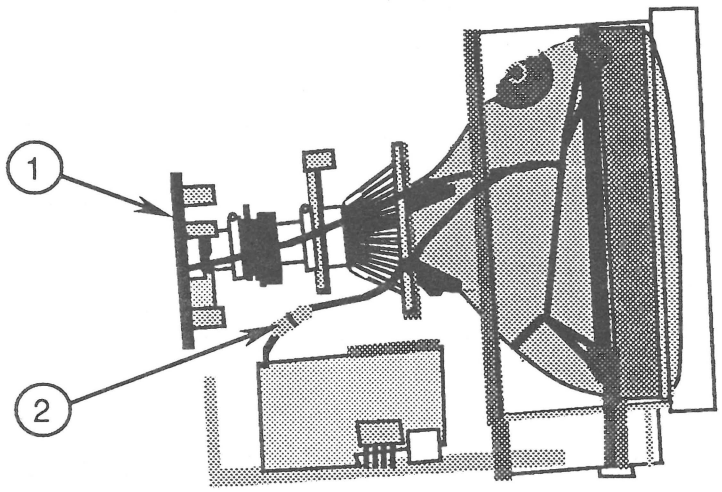


FIGURE 14

4. Carefully pull the CRT board (Figure 14, #1) off the neck of the CRT.
5. Turn the CRT board so that you can see the component side, and disconnect the gray CRT ground wire (Figure 15, #1).
6. Disconnect the white CRT ground wire from its plug-in connector beneath the CRT neck (Figure 14, #2).

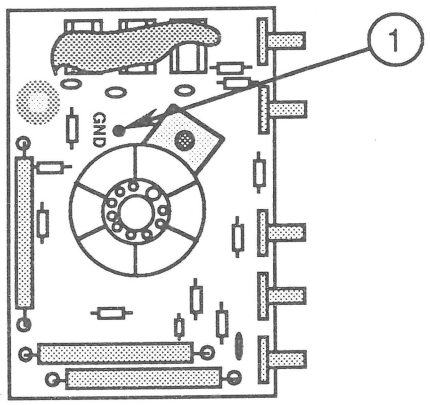


FIGURE 15

7. Disconnect the degaussing coil ground strap (Figure 16, #1) from the connector marked **W** on the main logic PCB.

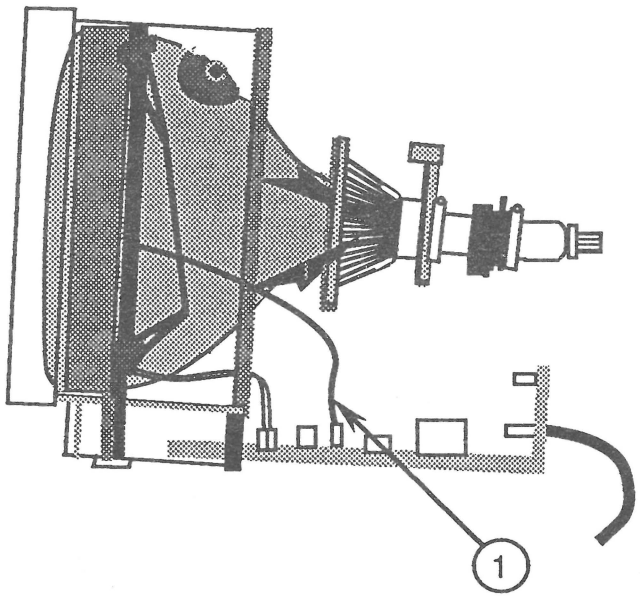


FIGURE 16

8. Disconnect the on/off switch from its bracket:

   If the monitor is a IIe:

   a) Remove the two screws (Figure 17, #1) that secure the on/off switch bracket to the front bezel.

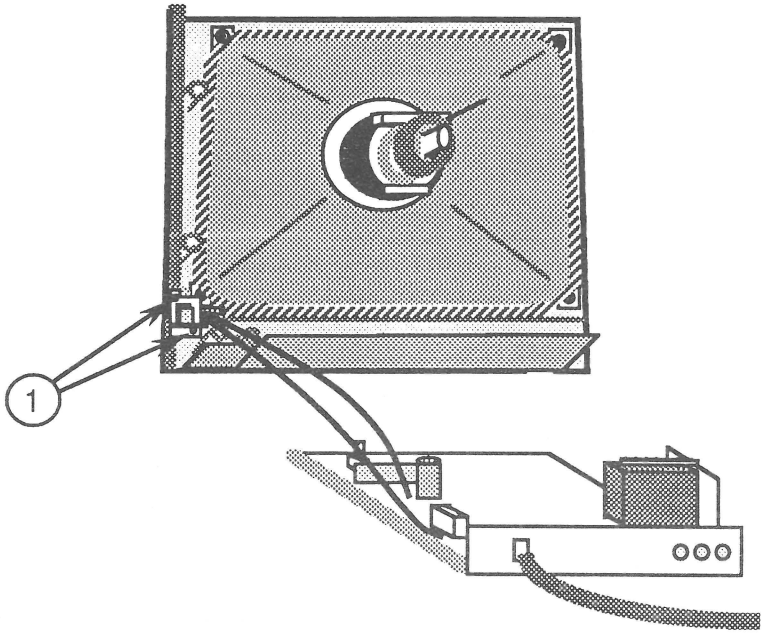


FIGURE 17

   b) Pull the plastic knob off the on/off switch shaft.

   c) Remove the two screws that secure the on/off switch to its plastic mounting bracket.

   If the monitor is a IIc:

   a) Pull the plastic switch button (Figure 18, #1) off the on/off swich shaft.

   b) Remove the screw (Figure 18, #2) that secures the on/off switch to the plastic bracket.

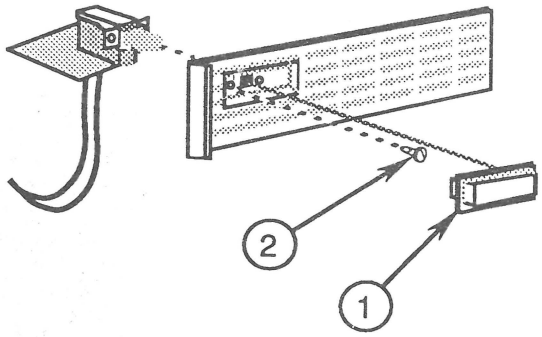


FIGURE 18

9. Disconnect the LED cable (Figure 19, #1) from the small, vertically mounted video PCB attached to the main logic PCB (Figure 19, #2).

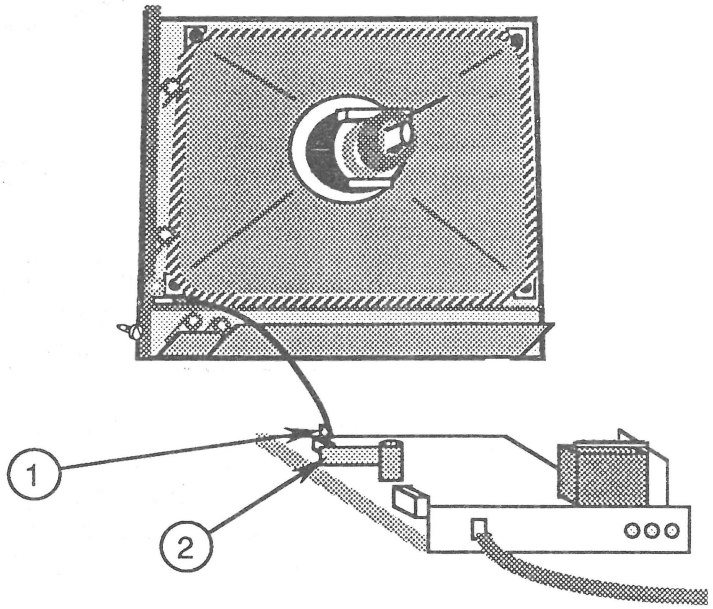


FIGURE 19

10. Slide the main logic board assembly out from under the CRT neck.

11. Disconnect the CRT connector (red/blue/yellow/ green) from the power supply board (Figure 20, #1).

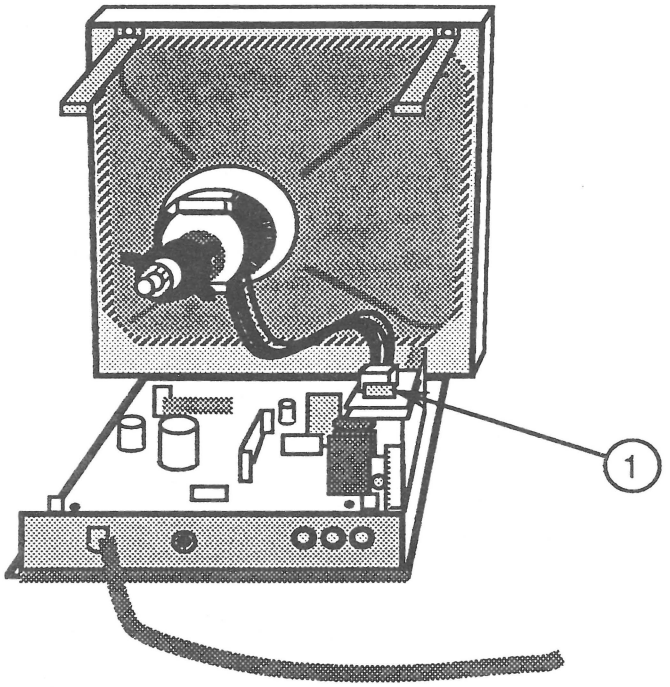


FIGURE 20

CAUTION: *Be careful when removing the control knobs from the main logic PCB. Twisting or yanking on the knobs can cause severe damage to the board.*

12. Remove the five plastic control knobs from the control PCB, which is attached to the main logic PCB. While holding the control knob mounting piece down with one hand, carefully pull each plastic knob off its shank.

13. Remove the two screws holding the two upper case-support brackets to the bezel (Figure 21, #1).

14. Remove the two screws (Figure 21, #2) that secure the back panel to the main logic PCB.

15. Remove the single screw that holds the power cord in place (Figure 22, #1).

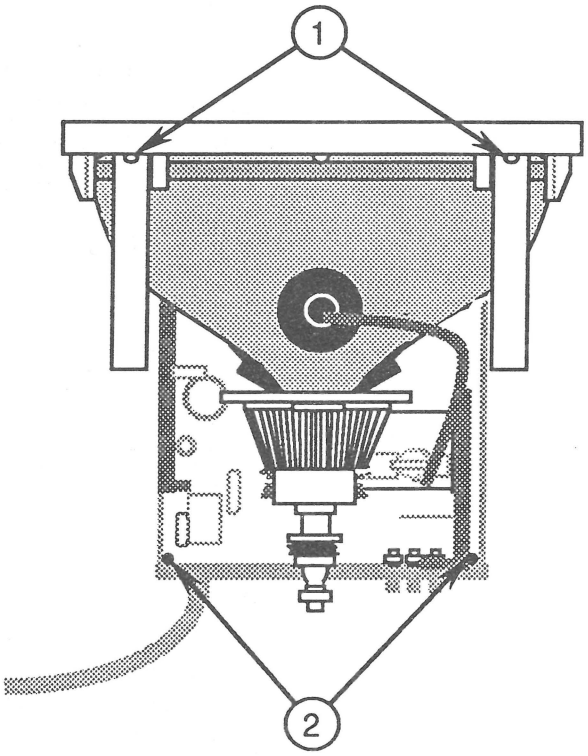


FIGURE 21

16. Pull off the plastic holding piece that fits underneath the power cord (Figure 22, #2), and remove the rear panel.

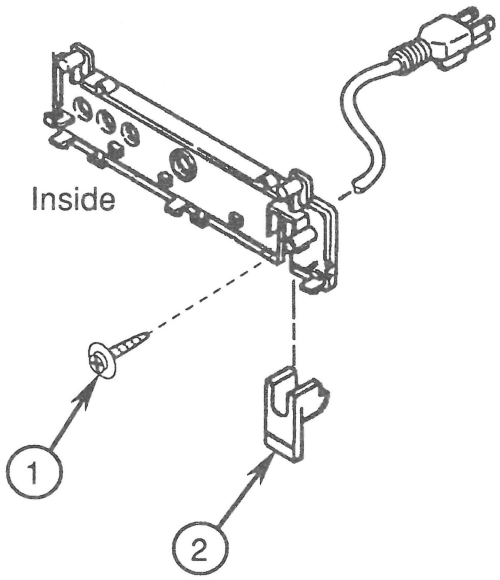


FIGURE 22

17. Remove the three rear plastic control knobs at the rear of the main logic PCB. While holding the control knob mounting down with one hand, carefully pull each plastic knob off its shank.

18. Keep the following items to install on the replacement main logic board assembly:

    - Rear panel and plastic holding piece
    - Control knobs (five front, three rear, one power)
    - Metal on/off switch bracket
    - All screws

19. Return the following items to Apple with the logic board:

    - Uninsulated IIe upper case-support brackets
    - IIe extension bracket (located between the IIe main logic board and the control PCB)

Replace

1. If the monitor is a ColorMonitor IIc, begin this procedure at step 3.

2. If the monitor is a ColorMonitor IIe, install the extension bracket between the main logic PCB and the control PCB as follows:

    a) With the tab (Figure 23, #1) pointing up, align the holes on the smooth side of the bracket with the holes on the two tabs projecting out of the metal frame.

b) Install the two screws (Figure 23, #2) that secure the extension bracket to the metal frame.

c) Position the control PCB under the extension bracket tab.

d) Install the two screws (Figure 23, #3) that secure the control PCB to the extension bracket.

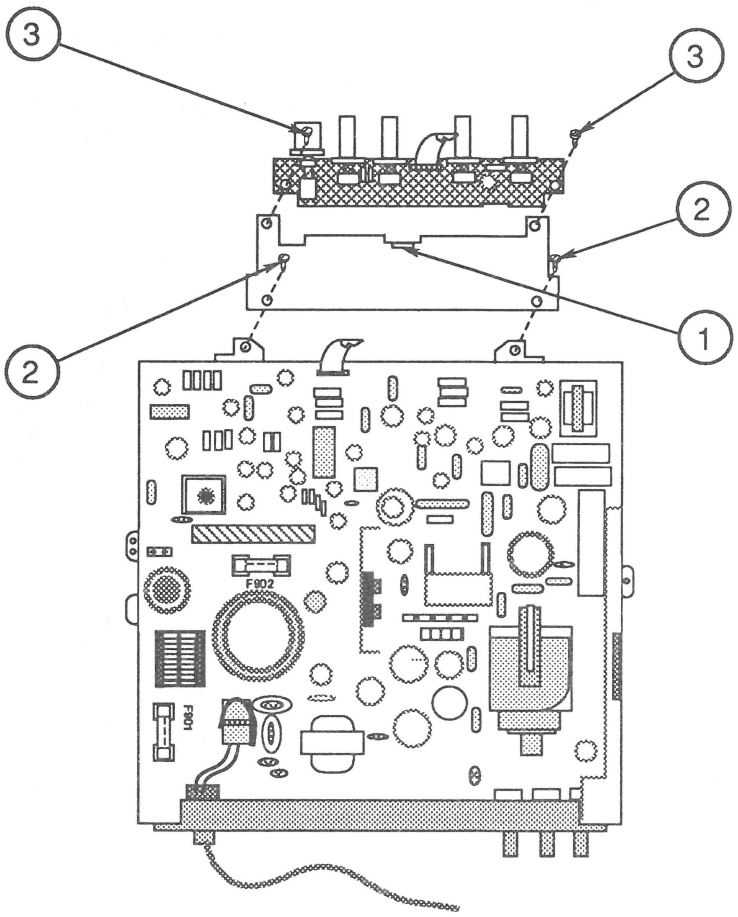


FIGURE 23

3. Replace the five plastic control knobs and switch located on the control PCB (attached to the main logic PCB).

4. Replace the three plastic control knobs at the rear of the main logic PCB.

5. Replace the rear panel as follows:

   a) Select a rear panel from the logic board replacement kit, or use the rear panel that you previously removed from the customer's monitor.

   b) Fit the rear panel over the AC power cord (Figure 24, #1).

   c) Slide the matching small plastic holding piece (Figure 24, #2) under the cord until it fits securely under the power cord.

   d) Replace the screw that holds the power cord in place (Figure 24, #3)

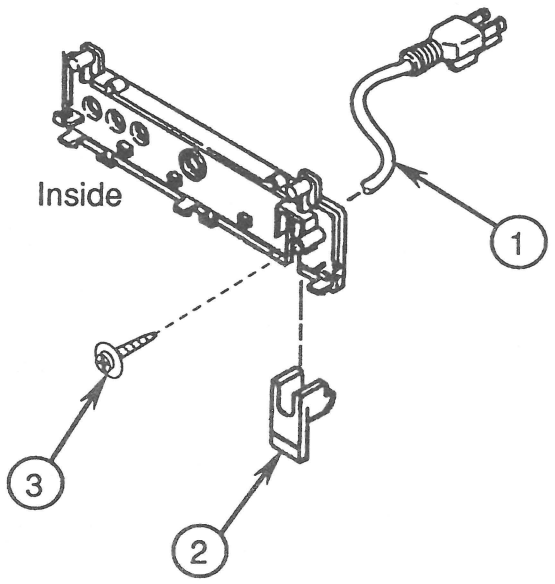


FIGURE 24

6. Fit the rear panel over the three rear control knobs, making sure the plastic "teeth" on the bottom of the panel fit into the openings on the metal chassis (Figure 25, #1).

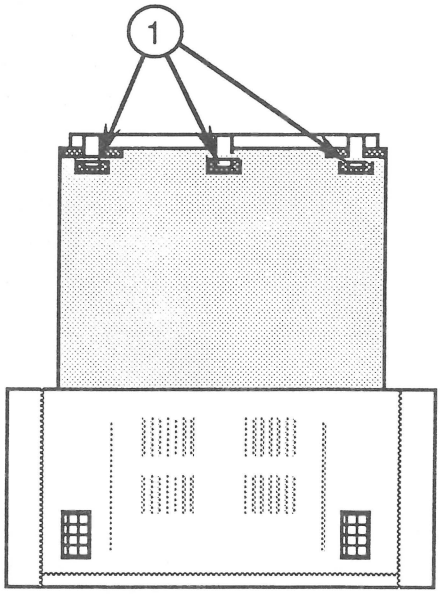


FIGURE 25

7. Replace the two screws (Figure 26, #1) that secure the back panel to the main logic PCB.

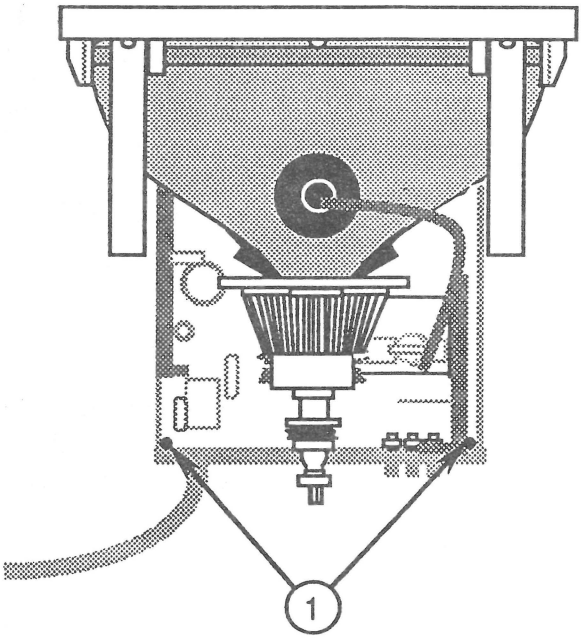


FIGURE 26

8. Install the two insulated upper case supports from the logic board replacement kit. To do this, replace the two screws that secure the upper case supports to the top of the bezel (Figure 27, #1).

WARNING: *These insulated brackets must be installed whenever you place a Rev. B logic board service module on a Rev. A monitor chassis. Failure to do so can result in a possible electroshock hazard for the user.*

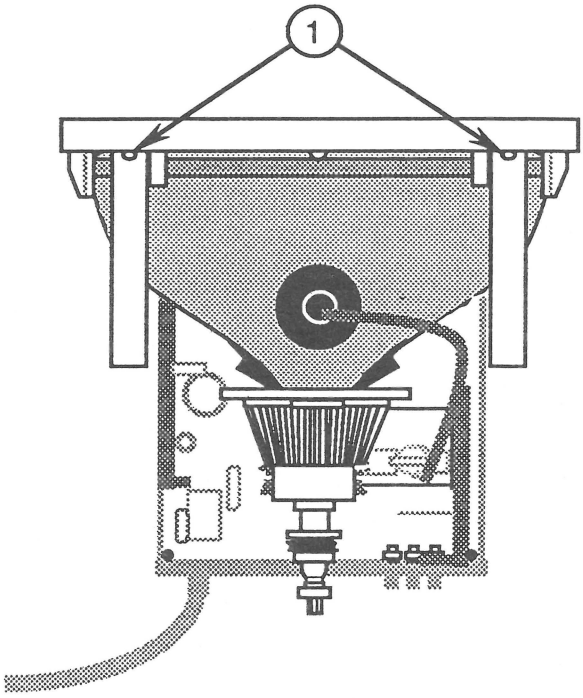


FIGURE 27

9. With the front bezel (with CRT) on its feet, slide the main logic board under the CRT neck about three inches away from the base of the CRT.

10. Reconnect the LED cable (Figure 28, #1) to the small, vertically mounted video PCB attached to the main logic PCB (Figure 28, #2).

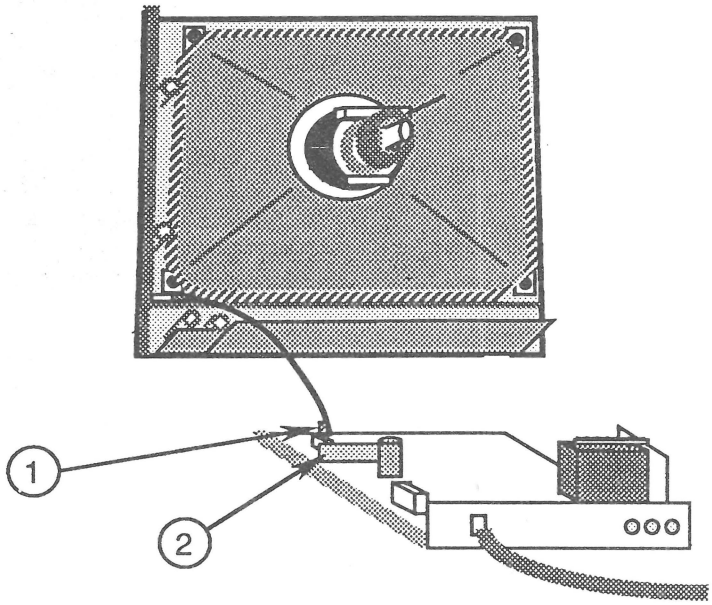


FIGURE 28

11. Reconnect the on/off switch:

    If the monitor is a IIe:

    a) Replace the two screws that secure the switch assembly to its mounting bracket.

    b) Replace the customer's switch button on its shaft.

c) Replace the two screws that secure the on/off switch to the front bezel (Figure 29, #1).

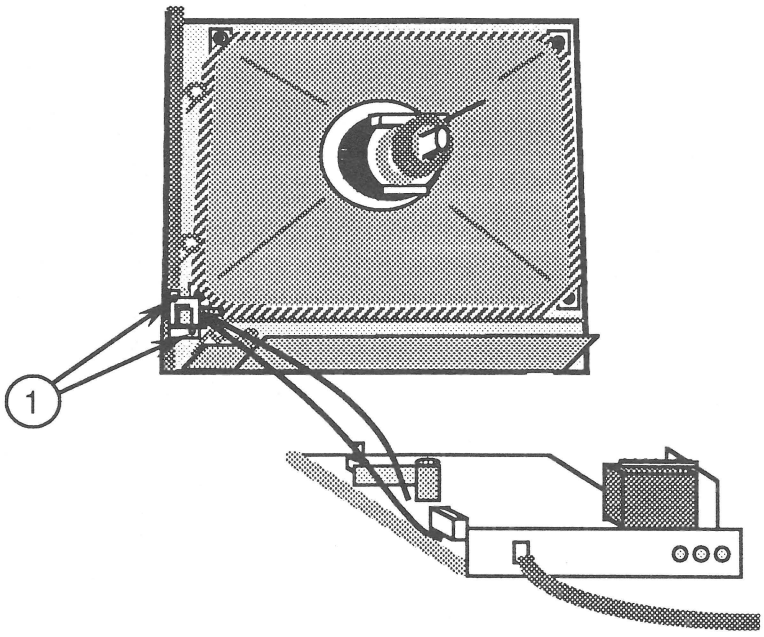


FIGURE 29

If the monitor is a IIc:

a) Replace the screw (Figure 30, #1) that secures the on/off switch to the plasic bracket. The small switch PCB (Figure 30, #2) is on the bottom as you insert the switch unit into the plastic bracket.

b) Replace the customer's switch button (Figure 30, #3) on its shaft.

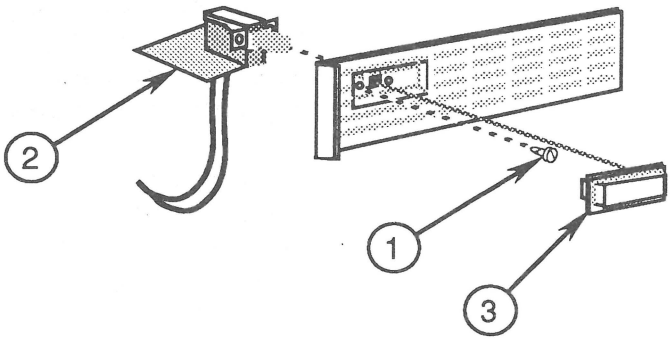


FIGURE 30

12. Reconnect the CRT connector (red/blue/yellow/ green) to the power supply board (Figure 31, #1).

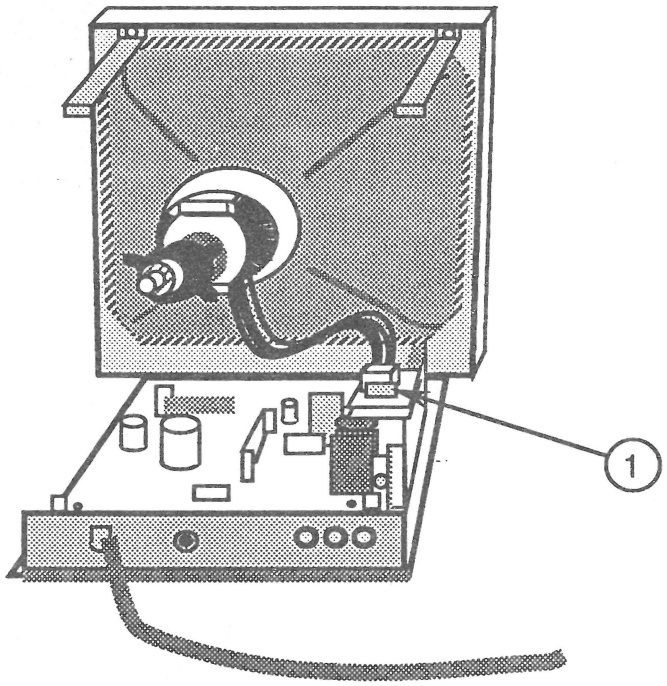


FIGURE 31

13. Slide the main logic PCB into the front bezel so that the control knobs fit through the holes in the front of the unit. **(In order for the main logic PCB to fit into the IIe bezel, you must have installed the extension bracket, as directed in Step 1 at the beginning of this procedure.)**

14. Reconnect the degaussing coil ground strap to connector **W** on the main logic PCB (Figure 32, #1), making sure the "**W**" on the side of the connector is matched to the "**W**" on the logic board.

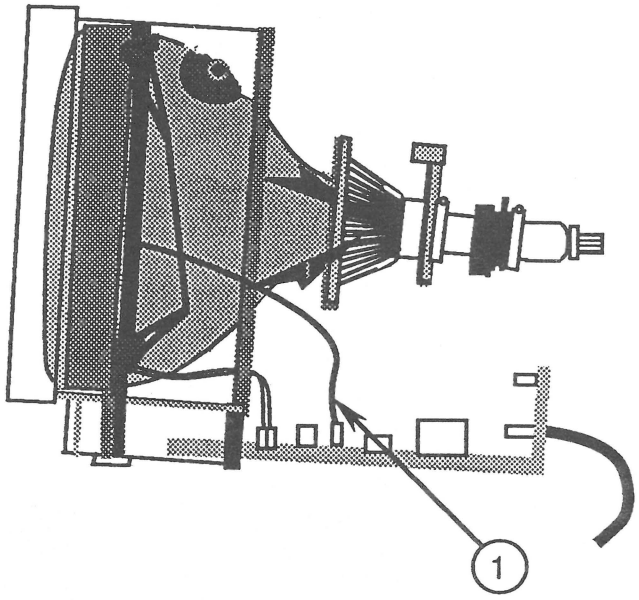


FIGURE 32

15. Reconnect the white CRT ground wire at its plug-in connector (Figure 33, #1).

16. Reconnect the gray CRT ground wire to the CRT board (Figure 34, #1).

17. Reconnect the CRT board to the CRT neck (Figure 33, #2). It fits only one way.

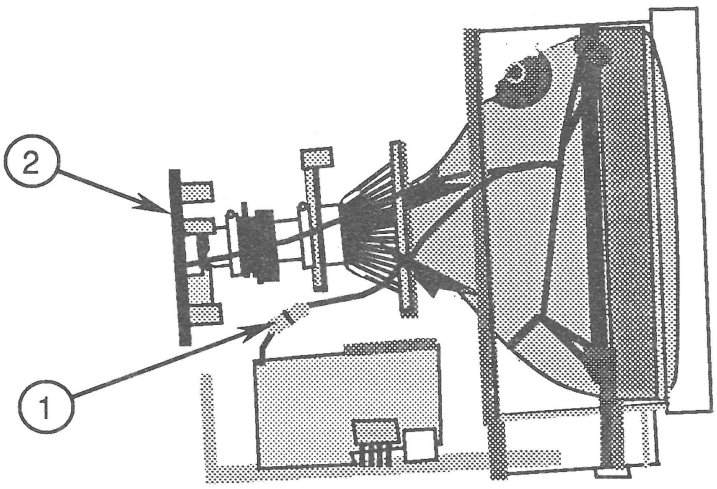


FIGURE 33

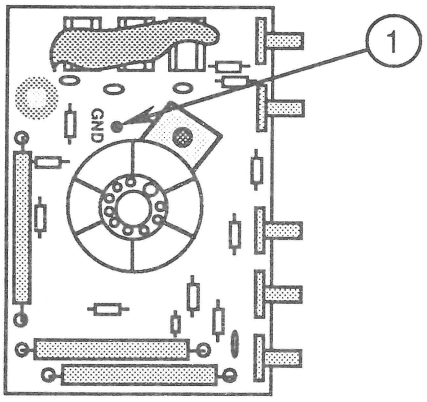


FIGURE 34

18. Replace the anode cap.

19. Replace all wires into the plastic cable clamps.

20. Replace the rear cover.

❑ MAIN LOGIC PCB (Rev. B only) – SERIES "H"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT, and remove the anode cap.
3. Remove all wires from the two plastic cable clamps.

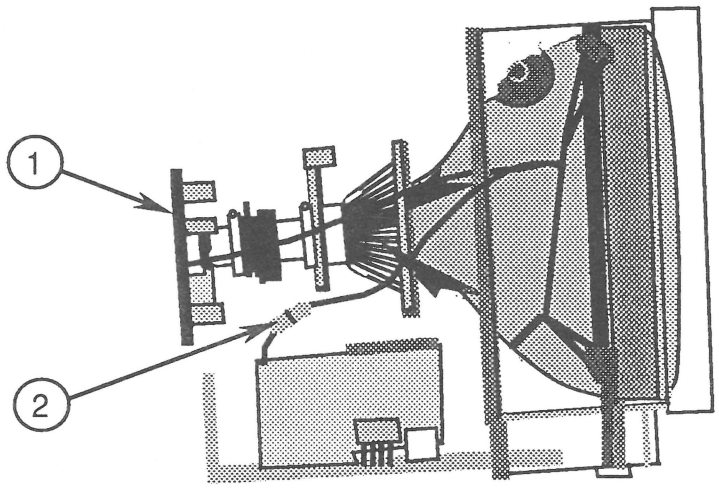


FIGURE 35

4. Carefully pull the CRT board (Figure 35, #1) off the neck of the CRT.
5. Turn the CRT board so that you can see the component side, and disconnect the gray CRT ground wire (Figure 36, #1).
6. Disconnect the white CRT ground wire from its plug-in connector beneath the CRT neck (Figure 35, #2).

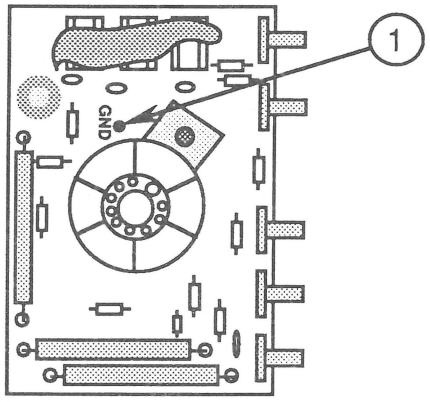


FIGURE 36

7. Disconnect the degaussing coil ground strap (Figure 37, #1) from the connector marked **W** on the main logic PCB.

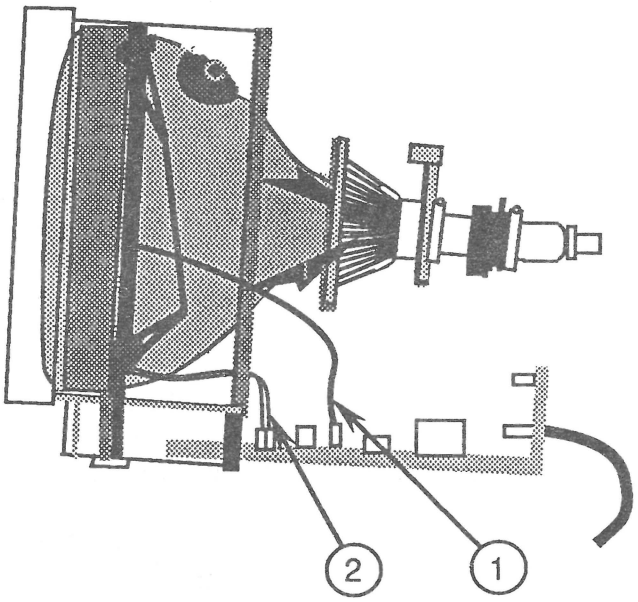


FIGURE 37

8. Disconnect the LED cable (Figure 37, #2) from the main logic PCB.

9. Disconnect the on/off switch from its bracket:

   If the monitor is a IIe:

   a) Remove the two screws (Figure 38, #1) that secure the on/off switch bracket to the front bezel.

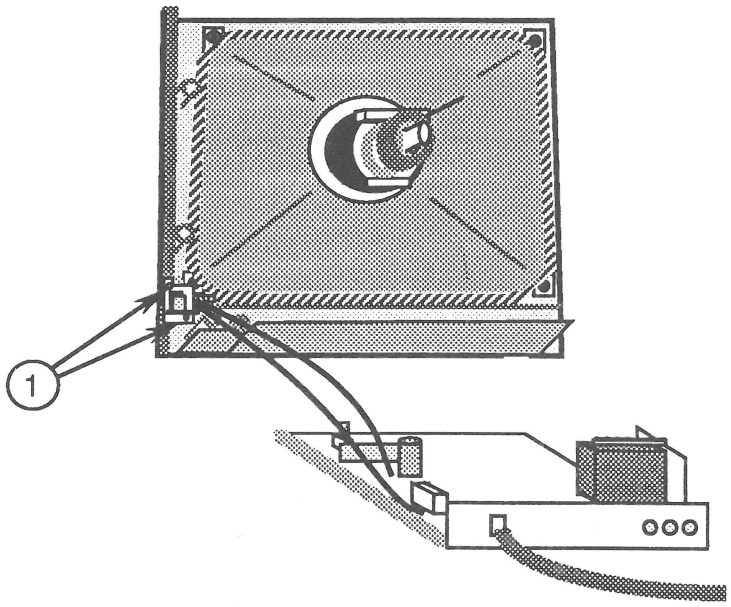


FIGURE 38

   b) Pull the plastic knob off the on/off switch shaft.

   c) Remove the two screws that secure the on/off switch to its plastic mounting bracket.

   If the monitor is a IIc:

   a) Pull the plastic switch button (Figure 39, #1) off the on/off switch shaft.

   b) Remove the screw (Figure 39, #2) that secures the on/off switch to the plastic bracket.

10. Remove the single screw (Figure 40, #1) that secures the green ground wire to the side of the chassis.

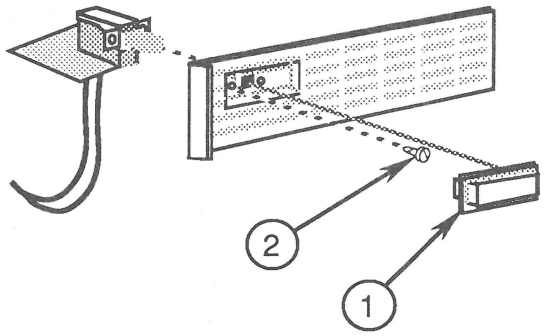


FIGURE 39

11. Slide the main logic board assembly out from under the CRT neck.

12. Disconnect the CRT connector (red/blue/yellow/green) from the logic board (Figure 40, #2).

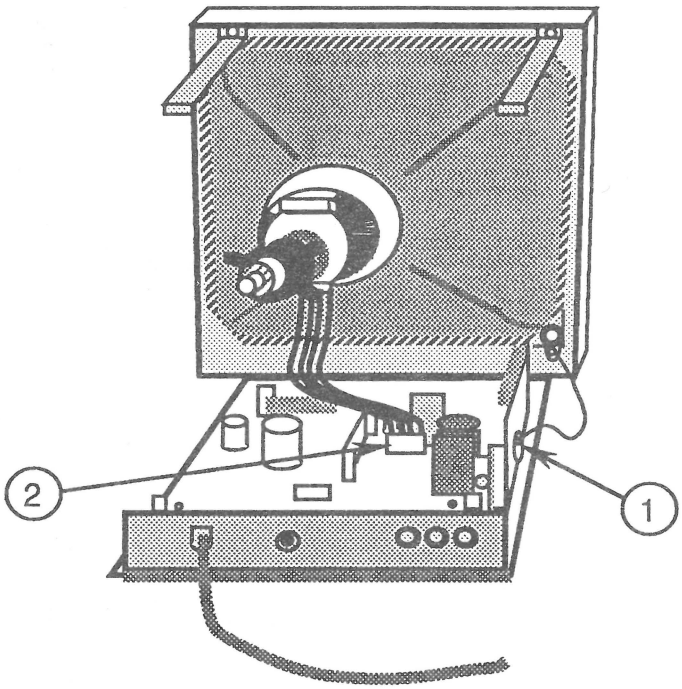


FIGURE 40

CAUTION: *Be careful when removing the control knobs from the main logic PCB. Twisting or yanking on the knobs can cause severe damage to the board.*

13. Remove the five plastic control knobs from the control PCB, which is attached to the main logic PCB. While holding the control knob mounting piece down with one hand, carefully pull each plastic knob off its shank.

14. Remove the two screws (Figure 41, #1) that secure the back panel to the main logic PCB.

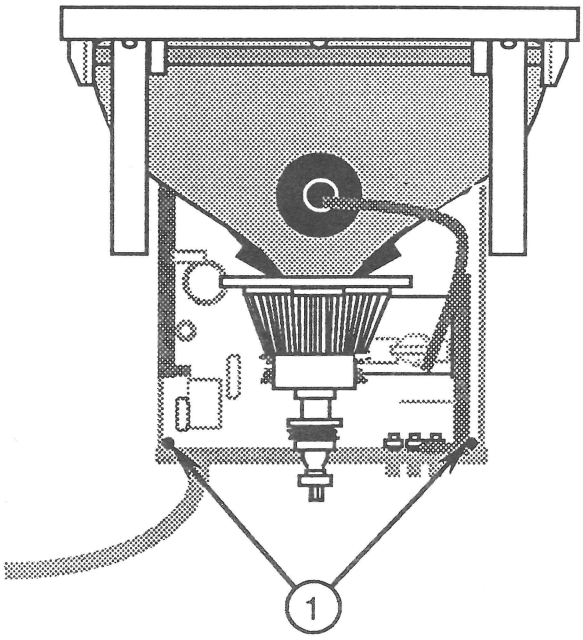


FIGURE 41

15. Remove the single screw that holds the power cord in place (Figure 42, #1).

16. Pull off the small plastic holding piece that fits underneath the power cord (Figure 42, #2), and remove the rear panel.

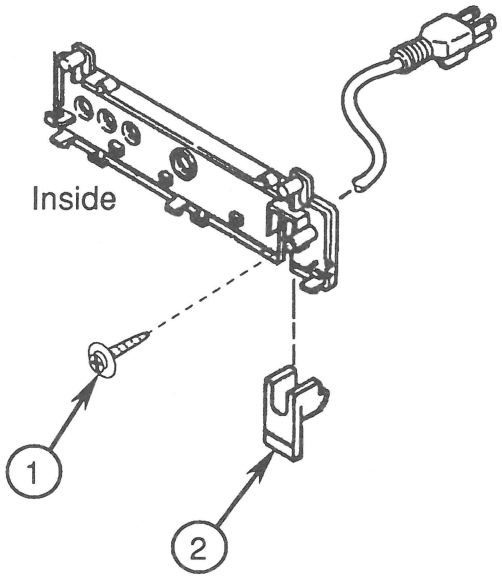


FIGURE 42

17. Remove the three control knobs at the rear of the main logic PCB. While holding the control knob mounting piece down with one hand, carefully pull each plastic knob off its shank.

18. Keep the following items to install on the replacement main logic PCB:

    - Rear panel and plastic holding piece
    - Control knobs (five front, three rear, one power)
    - On/off switch bracket
    - All screws

19. Return the ColorMonitor IIe extension bracket (located between the IIe main logic PCB and the control PCB) to Apple with the main logic PCB.

Replace

1. If the monitor is a ColorMonitor IIc, begin this procedure at step 3.

2. If the monitor is a ColorMonitor IIe, install the extension bracket between the main logic PCB and the control PCB as follows:

   a) With the tab (Figure 43, #1) pointing up, align the holes on the smooth side of the bracket with the holes on the tabs projecting out of the metal frame.

   b) Install the two screws (Figure 43, #2) that secure the extension bracket to the metal frame.

   c) Position the control PCB under the extension bracket tab.

   d) Install the two screws (Figure 43, #3) that secure the control PCB to the extension bracket.

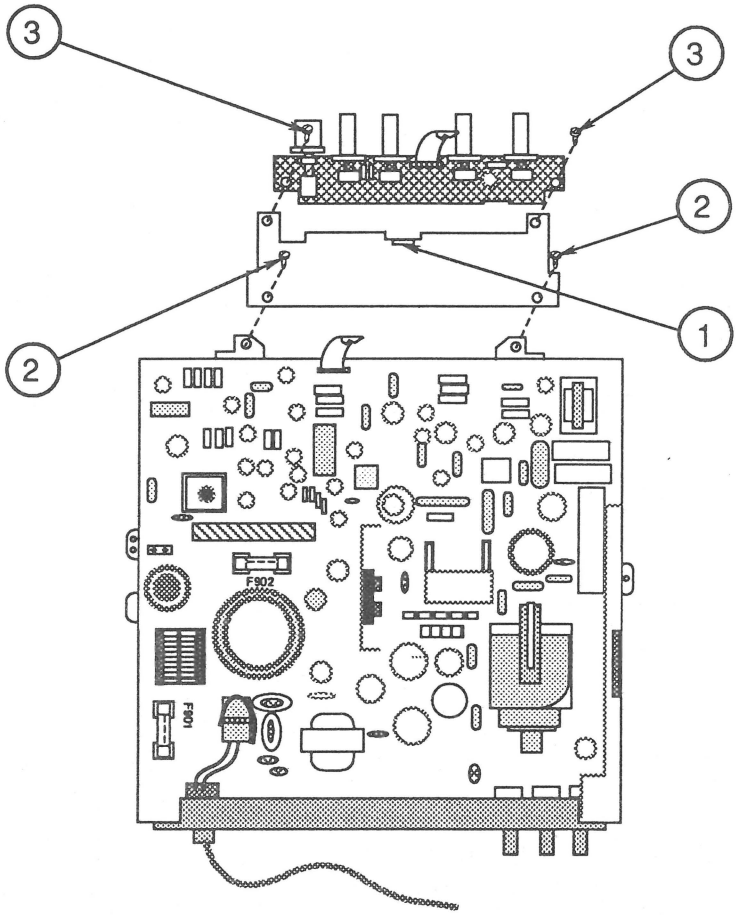


FIGURE 43

3. Replace the five plastic control knobs and switch located on the control PCB.

4. Replace the three plastic control knobs located at the rear of the main logic PCB.

5. Replace the rear panel as follows:

   a) Select a rear panel from the logic board replacement kit, or use the rear panel that you previously removed.

   b) Fit the rear panel over the AC power cord (Figure 44, #1).

   c) Slide the matching small plastic holding piece (Figure 44, #2) under the cord until it fits securely under the power cord.

   d) Replace the screw that holds the power cord in place (Figure 44, #3).

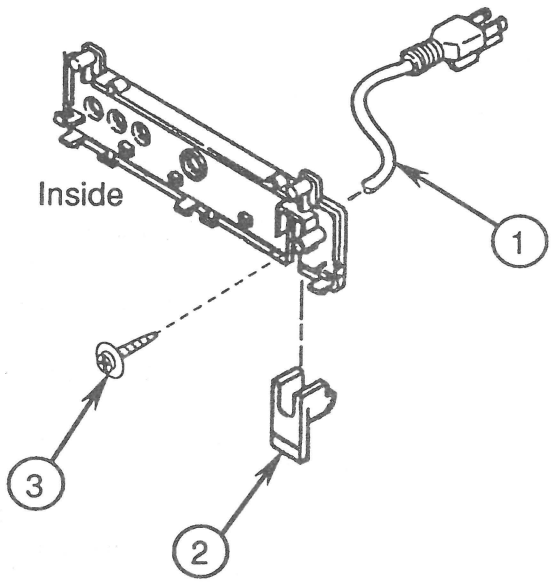


FIGURE 44

6. Fit the rear panel over the three rear control knobs, making sure the plastic "teeth" on the panel fit into the openings in the bottom of the metal chassis (Figure 45, #1).

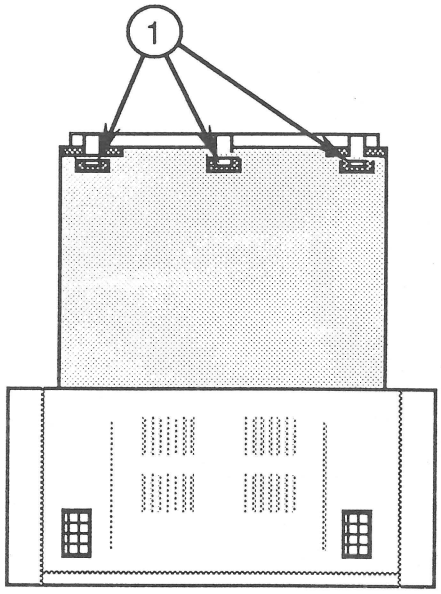


FIGURE 45

7. Replace the two screws (Figure 46, #1) that secure the back panel to the main logic PCB.

8. With the front bezel (with CRT) on its feet, slide the main logic board under the CRT neck about three inches away from the base of the CRT.

9. Reconnect the on/off switch:

   If the monitor is a IIe:

   a) Replace the two screws that secure the switch assembly to its mounting bracket.

   b) Replace the customer's switch button on its shaft.

   c) Replace the two screws that secure the on/off switch to the front bezel (Figure 47, #1).

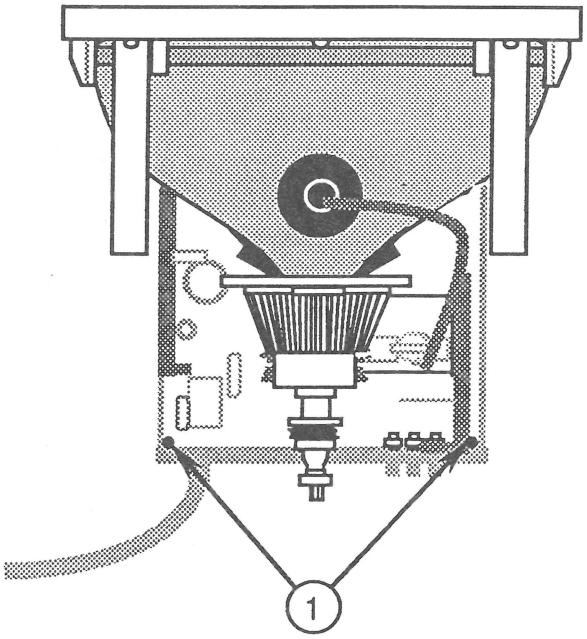


FIGURE 46

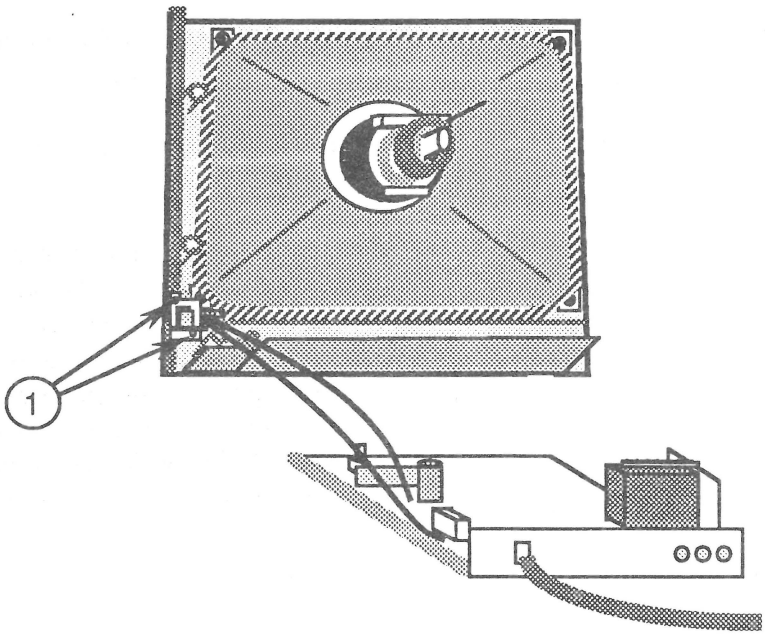


FIGURE 47

If the monitor is a IIc:

a) Replace the screw (Figure 48, #1) that secures the on/off switch to the plastic bracket. The small switch PCB (Figure 48, #2) is on the bottom as you insert the switch unit into the plastic bracket.

b) Replace the customer's switch button (Figure 48, #3) on its shaft.

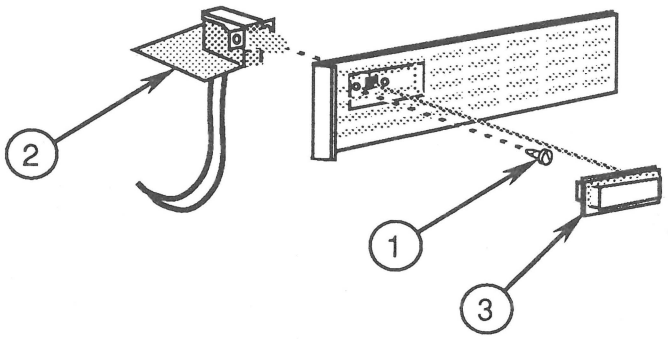


FIGURE 48

10. Reconnect the CRT connector (red/blue/yellow/green) to the logic board (Figure 49, #2).

11. Reconnect the red and white LED cable to the main logic PCB.

Note: **If you have replaced a faulty Rev. A logic board with a Rev. B logic board (or vice versa), the LED will not work** because the polarity of the LED circuitry was reversed when the board was redesigned. The problem can be corrected by reversing the leads on the LED. For directions, see "LED Polarity Reversal Procedure – Series H" in Section 0, Service Notes.

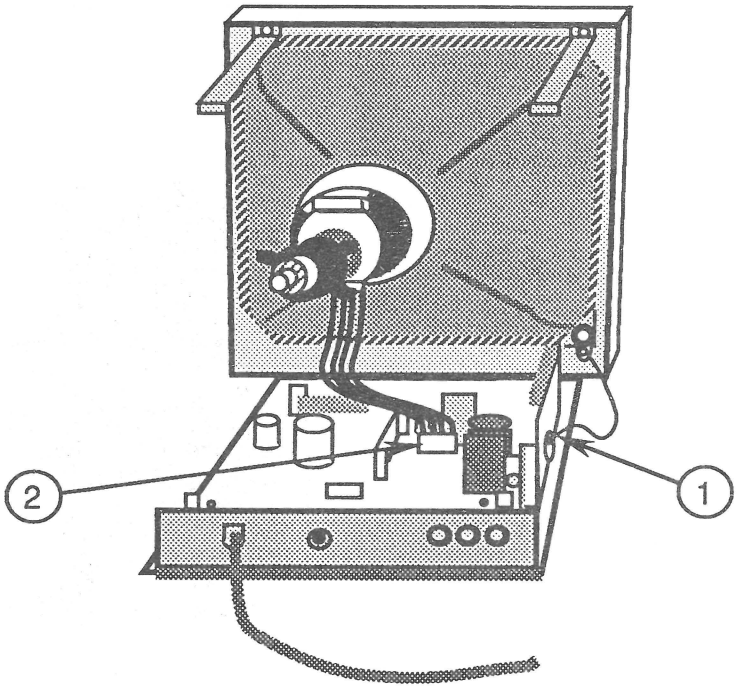


FIGURE 49

12. Slide the main logic PCB into the front bezel so that the control knobs fit through the holes in the front of the unit. **(In order for the main logic PCB to fit into the IIe bezel, you must have installed the extension bracket, as directed in Step 1 at the beginning of this procedure.)**

13. Replace the single screw (Figure 49, #1) that secures the green CRT ground wire to the side of the monitor chassis.

14. Reconnect the degaussing coil ground strap to connector **W** on the main logic PCB (Figure 50, #1), making sure the "**W**" on the side of the connector is on the same side as the "**W**" on the logic board.

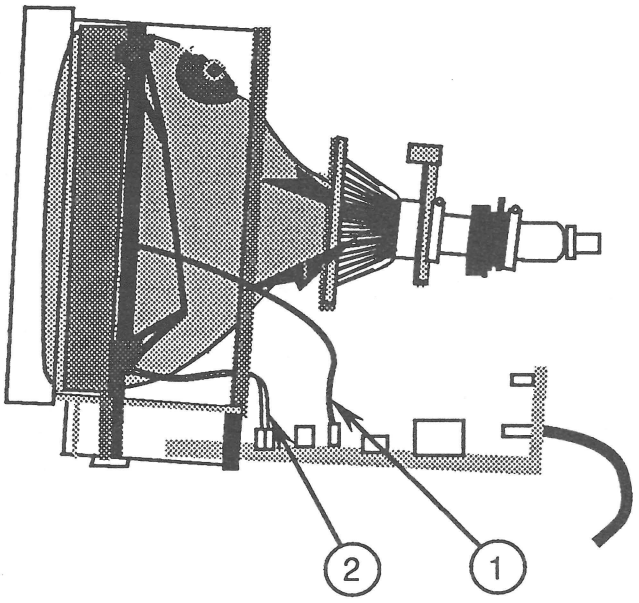


FIGURE 50

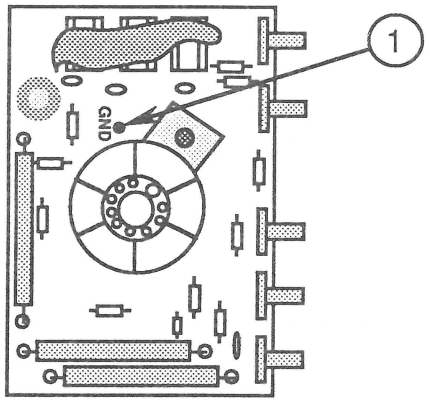


FIGURE 51

15. Reconnect the gray CRT ground wire to the CRT board (Figure 51, #1).

16. Reconnect the white CRT ground wire at its plug-in connector (Figure 52, #1).

17. Reconnect the CRT socket board to the CRT neck (Figure 52, #2). It fits only one way.

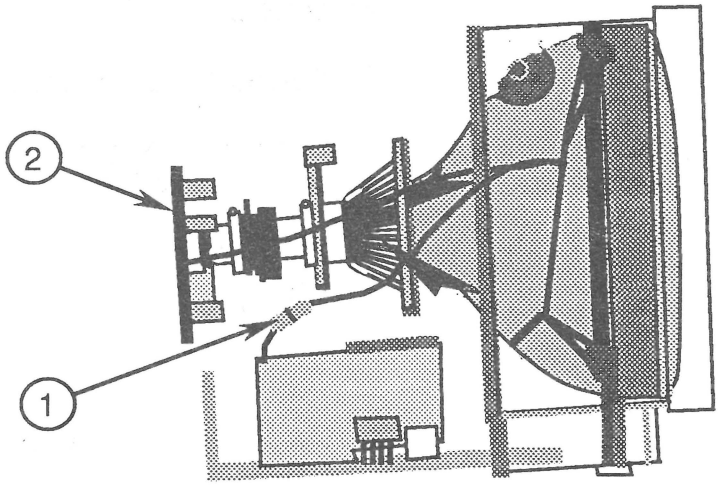


FIGURE 52

18. Replace wires in the two plastic cable clamps.

19. Replace the anode cap.

20. Replace the rear cover.

❑ CATHODE-RAY TUBE (CRT) (IIe ColorMonitor only) – SERIES "H"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT, and remove the anode cap.
3. Remove the main logic PCB.
4. Carefully place the monitor face down on a soft, protective surface.
5. Unscrew the four CRT mounting screws (Figure 53, #1).

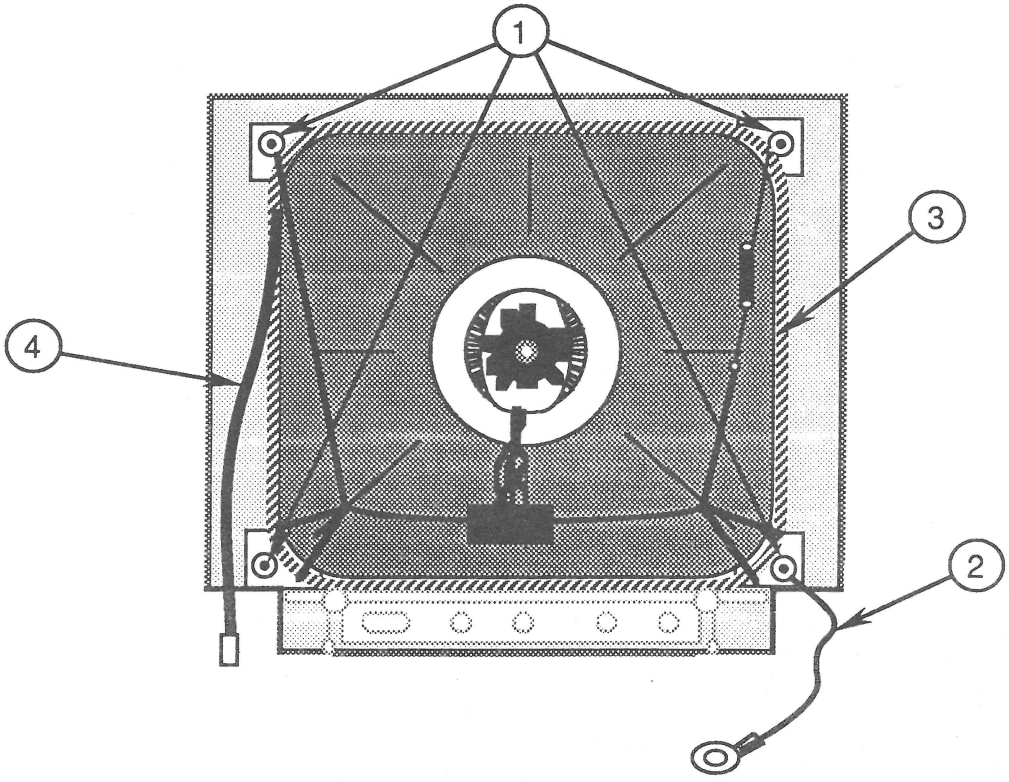


FIGURE 53

6. Carefully grasp the sides of the CRT (not the neck) and lift the CRT out of the bezel.

7. Remove the green CRT ground wire (Figure 53, #2) positioned between the CRT mounting bracket and the bezel.

   Note: The green CRT ground wire may not be present in all versions of the ColorMonitor IIe.

8. Lift the degaussing coil (Figure 53, #3) out of the bezel.

WARNING: *If you intend to dispose of the CRT, refer to "Disposing of the Cathode-Ray Tube" in Section 8, CRT Safety, under the* You Oughta Know *tab.*

Replace

1. Place the front bezel face down on a clean, soft surface.

2. Place the degaussing coil around the inside front of the bezel, making sure the degaussing coil ground strap (Figure 53, #4) is on the left side as you face the back of the monitor.

3. Carefully place the CRT in the bezel.

4. Replace the green CRT ground wire (Figure 53, #2), making sure the wire is positioned between the lower-right mounting bracket and the bezel as you face the back of the monitor.

5. Replace the four CRT mounting screws (Figure 53, #1).

6. Replace the main logic PCB.

7. Replace the rear cover.

❑ CATHODE-RAY TUBE (CRT) (IIc ColorMonitor only) – SERIES "H"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT, and remove the anode cap.
3. Remove the main logic PCB.
4. Carefully place the monitor face down on a soft, protective surface.
5. Unscrew the four CRT mounting screws (Figure 54, #1).

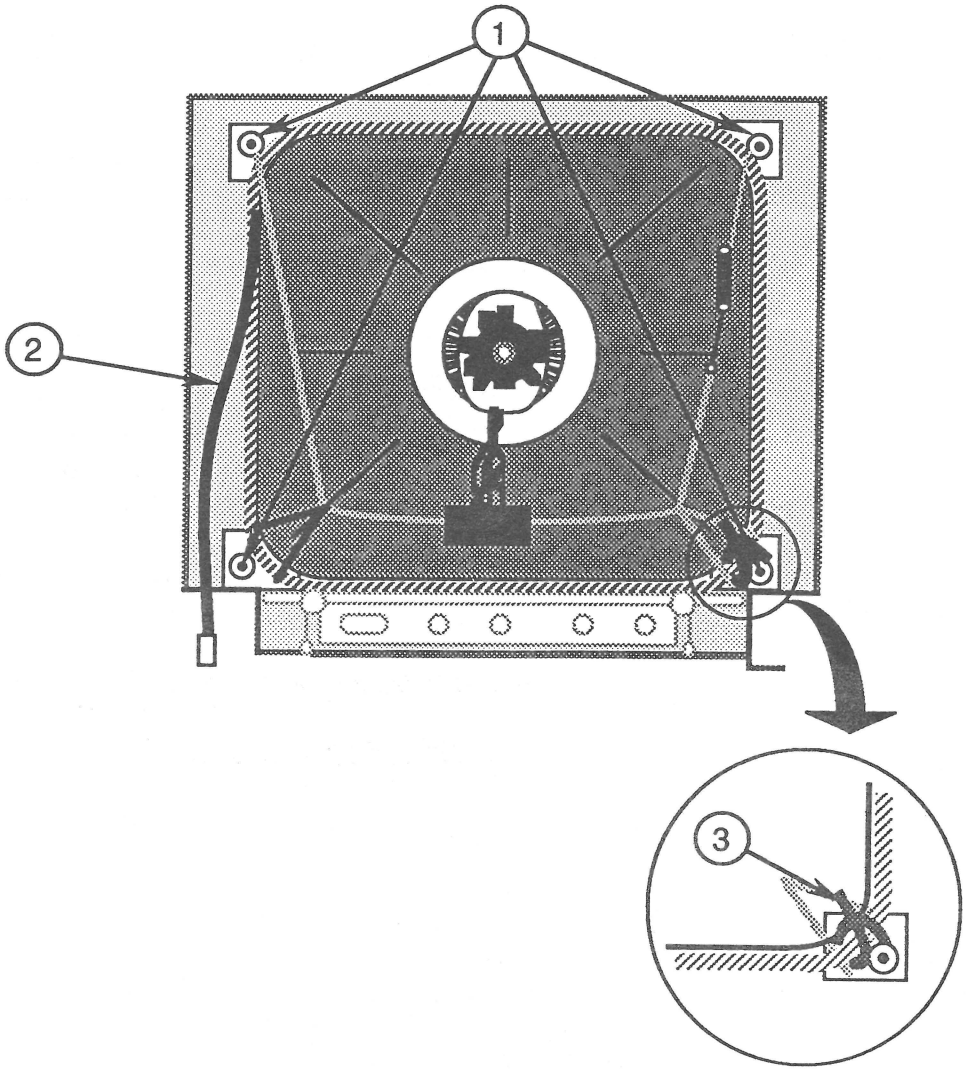


FIGURE 54

6. Carefully grasp the sides of the CRT (not the neck) and lift the CRT/degaussing coil assembly out of the bezel.

WARNING: *If you intend to dispose of the CRT, refer to "Disposing of the Cathode-Ray Tube" in Section 8, CRT Safety, under the* You Oughta Know *tab.*

Replace

1. Place the front bezel face down on a clean, soft surface.

2. Carefully place the CRT/degaussing coil assembly into the front bezel, making sure the degaussing coil ground strap (Figure 54, #2) is on the left side as you face the back of the monitor.

3. Tighten the four CRT mounting screws (Figure 54, #1) through the mounting brackets at the corners of the CRT. Make sure each screw is positioned through the plastic holding tabs (Figure 54, #3).

4. Replace the main logic PCB.

5. Replace the rear cover.

❑ LED ASSEMBLY (IIe Color Monitor only) – SERIES "H"

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT.
3. If the monitor is a ColorMonitor IIe, Rev. A, disconnect the LED cable from the small PCB that is attached to the main logic PCB (Figure 55, #1).

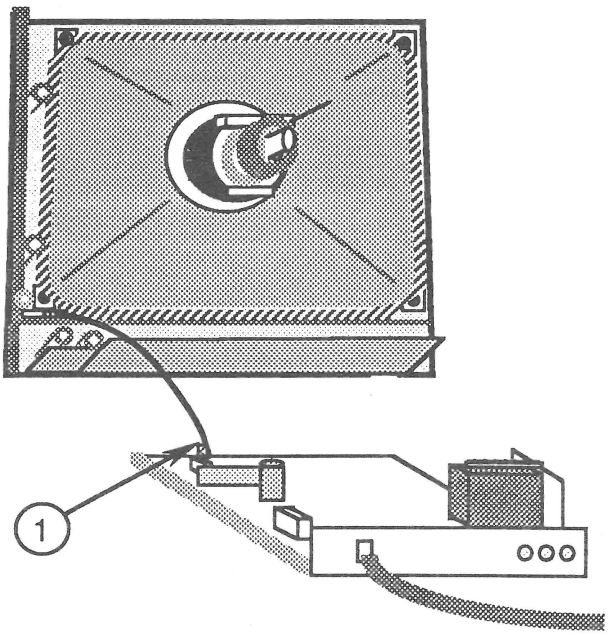


FIGURE 55

4. If the monitor is a ColorMonitor IIe, Rev. B, disconnect the LED cable from the main logic PCB.
5. Pull the LED free from the front bezel.

Replace

1. Position the LED assembly in its appropriate place inside the front bezel (Figure 56, #2).

2. Replace the clear plastic cap (Figure 56, #1) that secures the LED to the front bezel.

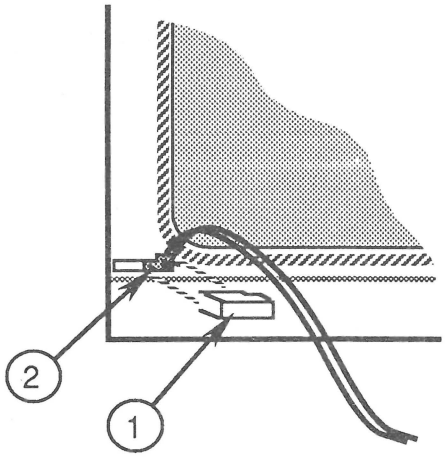


FIGURE 56

3. If the monitor is a ColorMonitor IIe, Rev. A, reconnect the LED cable to the small, vertically mounted video PCB attached to the main logic PCB (Figure 55, #1).

4. If the monitor is a ColorMonitor IIe, Rev. B, reconnect the LED cable to the main logic PCB.

   Note: The polarity of the LED circuitry on the ColorMonitor IIe, Series H, Rev. B, is reversed from that of Rev. A. This means that LEDs designed to work with Rev. A logic boards will not work with Rev. B logic boards. After you have reconnected the LED to the main logic board, power on the monitor to ensure that the LED lights. If it does not, reverse the leads of the LED. (See "LED Polarity Reversal Procedure - Series H" in Section 0, Service Notes.)

5. Replace the rear cover.

❑ LED ASSEMBLY (IIc ColorMonitor only) – SERIES "H"

Material Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT, and remove the anode cap.
3. Remove the main logic PCB.
4. Remove the CRT.
5. Remove the screw (Figure 57, #1) that secures the plastic bracket of the LED assembly to the front bezel.

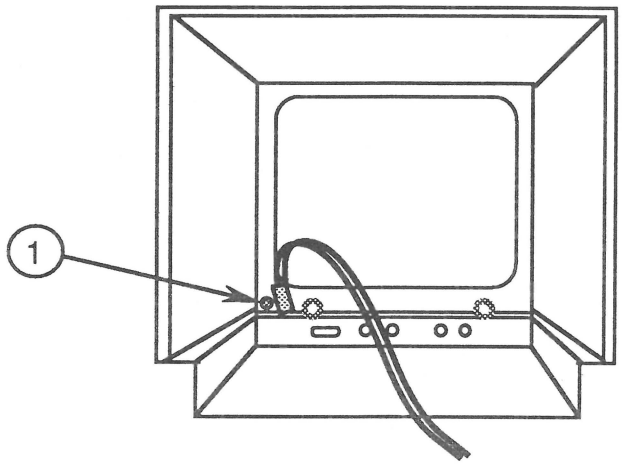


FIGURE 57

Replace

1. Replace the screw (Figure 57, #1) that holds the LED assembly in place inside the front bezel.
2. Replace the CRT.
3. Replace the main logic PCB.
4. Replace the rear cover.

❑ LOGIC BOARD FUSES (F901 and F902) – SERIES "H"

Materials Required

Medium Phillips screwdriver
Small flat-blade screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT.
3. Remove fuse F901 (Figure 58, #1). Gently pry up one end of the fuse with your fingers or a flat-blade screwdriver and lift the fuse out.

CAUTION: *Do not try to slide the fuse sideways. You may break the fuse holder.*

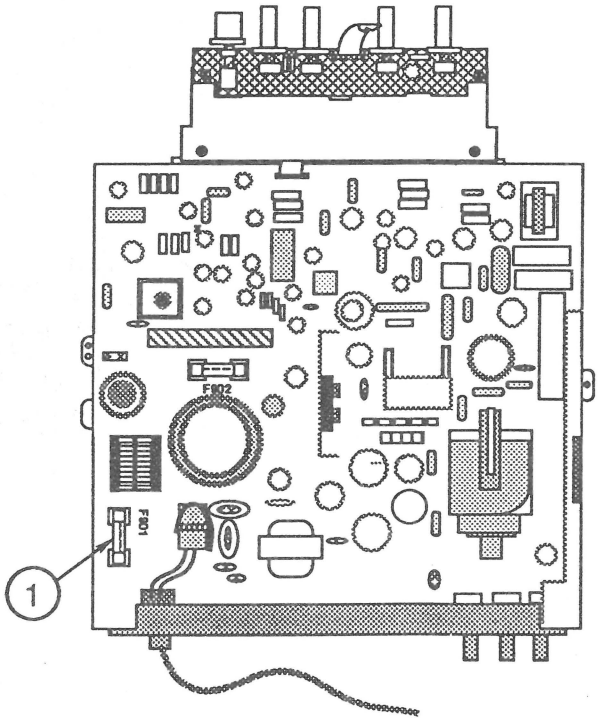


FIGURE 58

4. If fuse F901 is a 3.15 Amp 250V fuse, perform the Upgrade Procedure in Section 0, Service Notes. (The Upgrade Procedure replaces the 3.15 Amp 250 V fuse with a 4 Amp 125 V fuse.)

5. If fuse F901 is a 4 Amp 125 V fuse, check to see that it is good. If the fuse is not good, replace it.

6. Check fuse F902 (Figure 59, #1). If fuse F902 is burned out, replace it with a 1 Amp Fast Blow fuse.

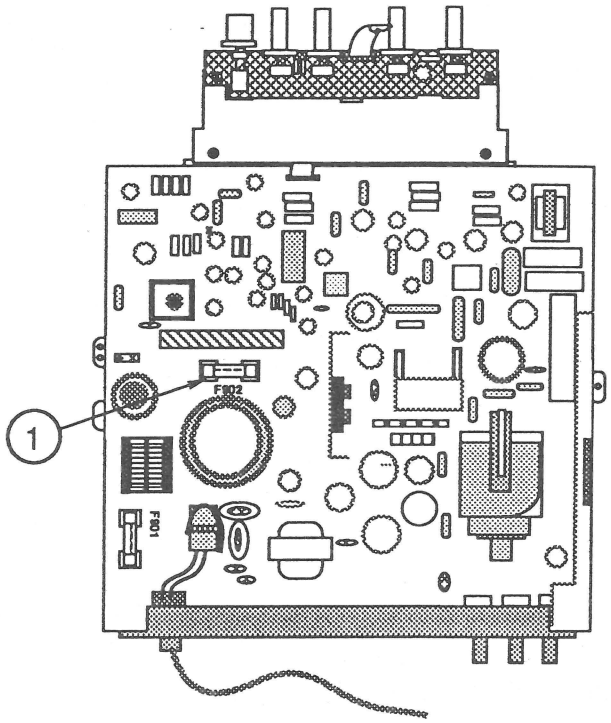


FIGURE 59

Replace

1. Carefully snap the new fuse into the fuse holder.

2. Replace the rear cover.

Apple ColorMonitor IIe/IIc
Technical Procedures

Section 4

Adjustments

Contents:

Introduction.....4.3
Text (Black & White) Adjustments.....4.5
Color Adjustments
  Materials Needed.....4.7
  Adjustment Procedure Series "S".....4.7
  Adjustment Procedure Series "H".....4.11

WARNING: The Series "H" Rev. B monitor and service module have an "AC/DC transformerless" design -- that is, there is no isolation transformer on the AC power circuit, and the chassis is connected to the neutral line. With such designs, IF THE POWER PLUG IS INSERTED BACKWARDS INTO THE OUTLET (OR IF THE OUTLET IS WIRED BACKWARDS) THE CHASSIS CARRIES A LETHAL CURRENT.

Use only a three-prong grounded electrical outlet installed by a qualified electrician, and do not under any circumstances use an adaptor plug. FOR YOUR SAFETY, APPLE URGES YOU TO USE AN ISOLATION TRANSFORMER BETWEEN THE MONITOR AND THE ELECTRICAL OUTLET.

DO NOT ATTEMPT TO MAKE ANY ADJUSTMENTS ON THE REV. B MONITOR OTHER THAN THOSE DIRECTED HEREIN, AND DO THOSE WITH EXTREME CAUTION!!!

The Series "H" Rev. B monitors and service modules may be identified by the absence of a separate power supply board.

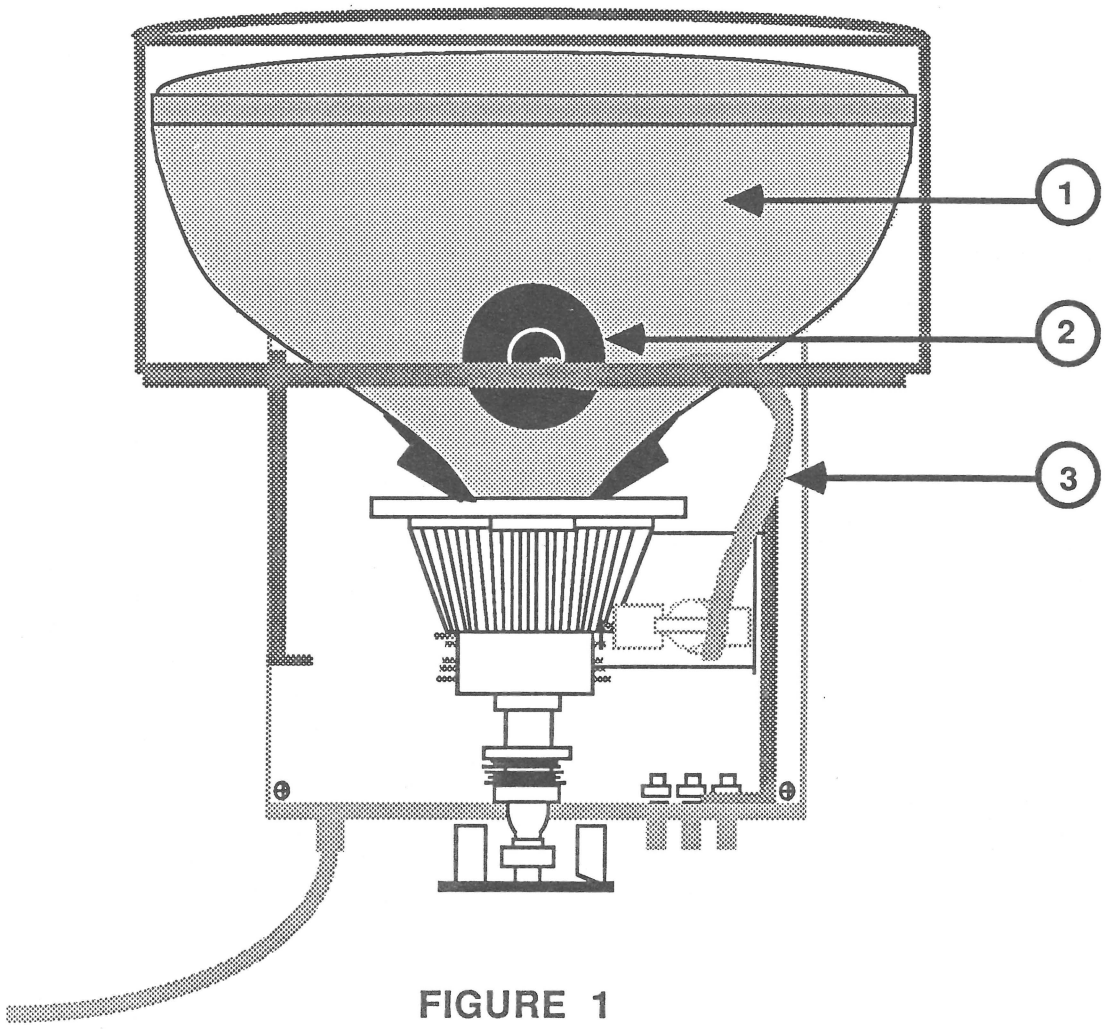


FIGURE 1

INTRODUCTION

The ColorMonitor IIe/IIc has two modes of operation - text and color. In exceptional circumstances one or both modes may need adjustment following the replacement of the main logic PCB or other modules. After any such service, check the text and color production by viewing any program(s) generating text (black & white) and color.

DO NOT CHANGE THE INTERNAL COLOR ADJUSTMENTS IF THE COLOR PRODUCTION IS WITHIN ACCEPTABLE RANGE! Perfect color adjustments require special equipment. The color adjustments given in this section will only allow you to achieve an acceptable level of color production in those rare cases where adjustment is necessary.

All yoke adjustments have been preset by the manufacturer. Do not attempt to make any tilt, ring, or geometric adjustments on the ColorMonitor. If the customer's monitor exhibits adjustment problems which cannot be corrected using the following procedures, use the procedures found in the "Troubleshooting" section to isolate the faulty module, and return that module to Apple for repair.

The Apple II Peripherals Diskette

The Apple II Peripherals Diskette contains test patterns you can use when making adjustments to this or any monitor. The monitor test patterns generated include:

Dot Pattern	40 Column Display	Color Bars
Grid Pattern	80 Column Display	Full White Screen

When a monitor needs adjustment, begin by adjusting the text display, then adjust the color (graphics) display.

WARNING !!!

THERE ARE EXTREMELY HIGH VOLTAGES ON THE TUBE, THE ANODE, THE ANODE LEAD, AND IN THE POWER SUPPLY AREA. DURING THESE ADJUSTMENTS YOU WILL BE PUTTING YOUR HAND NEAR THESE HIGH VOLTAGE PARTS WHILE THE POWER IS ON. WATCH WHAT YOU ARE TOUCHING WHILE MAKING THESE ADJUSTMENTS. AVOID TOUCHING THE TUBE, ANODE, OR ANODE LEAD (FIGURE 1, #1, #2, AND #3), OR THE POWER SUPPLY AREA. USE ONLY ONE HAND TO MAKE ALL ADJUSTMENTS! NEVER HOLD THE CHASSIS WITH YOUR FREE HAND WHILE MAKING ADJUSTMENTS.

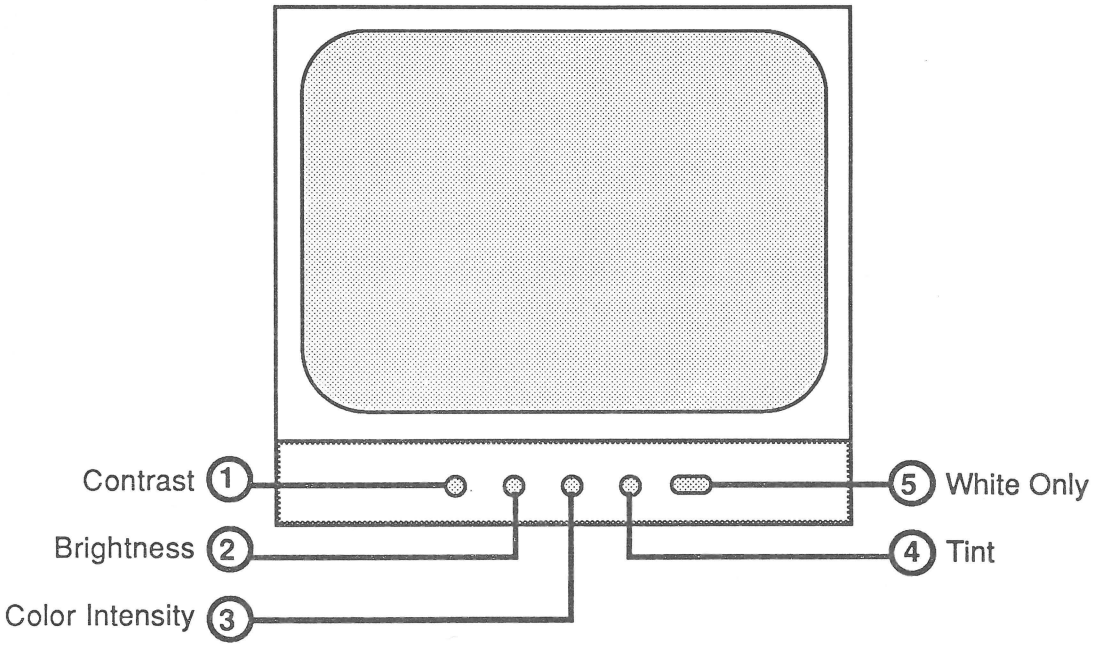


FIGURE 2

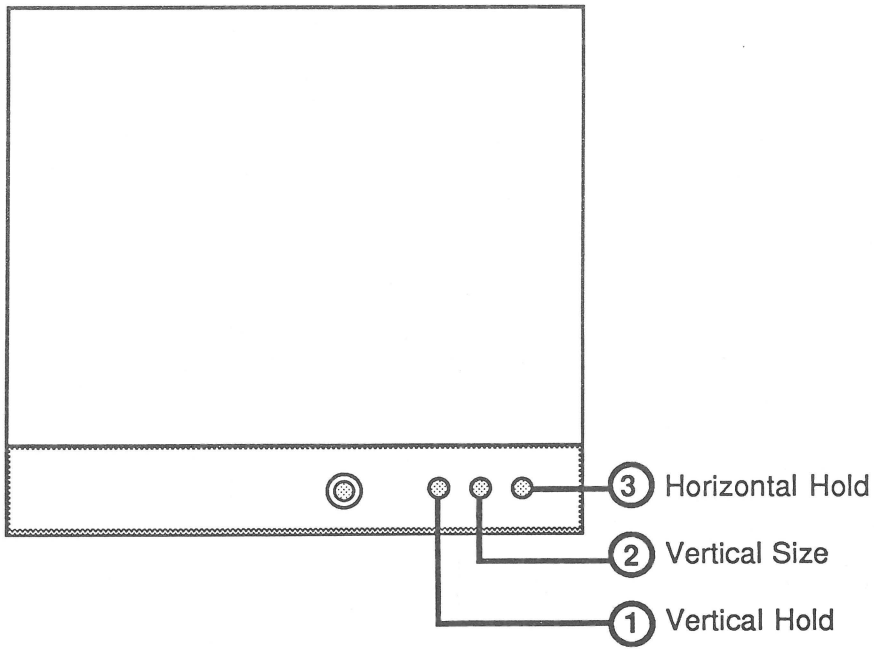


FIGURE 3

TEXT (BLACK AND WHITE) ADJUSTMENTS

Series "S" and Series "H"

Text adjustments are identical for Series "S" and Series "H" monitors. All text adjustment controls are located on the front and rear panels of the monitor and thus are accessible to both the dealer and the customer.

1. Connect the video cable and the power cords of the monitor and the IIc or IIe computer. Load the Apple II Peripherals Diskette into the computer and turn on the computer and the monitor. (**NOTE:** Any program that generates a 40 or 80 column text display may be used in place of the Peripherals Diskette.)

2. Select "Monitor Tests" from the program's main menu.

3. Select "40 Column Display" or "80 Column Display" from the monitor menu.

4. Open the access door on the lower front of the monitor.

5. Turn the **BRIGHTNESS** control (Figure 2, #2) to adjust the visibility of the screen to room lighting conditions.

6. Rotate the **CONTRAST** control (Figure 2, #1) to achieve a good balance between character brightness and screen background.

   NOTE: The **COLOR INTENSITY** control (Figure 2, #3), the **TINT** control (Figure 2, #4), and the **WHITE ONLY** switch (Figure 2, #5) have no effect on the text display.

7. Locate the **VERTICAL HOLD** control on the back panel of the monitor (Figure 3, #1). If the picture is moving vertically, turn the control until the picture becomes stable.

8. If the picture looks stretched, so that the characters on the top and bottom lines are partially lost, or if the characters look squashed, turn the **VERTICAL SIZE** control (Figure 3, #2) until you have lengthened or shortened the picture to the desired degree.

9. If the picture is moving horizontally, turn the **HORIZONTAL HOLD** control (Figure 3, #3) until the picture becomes stable.

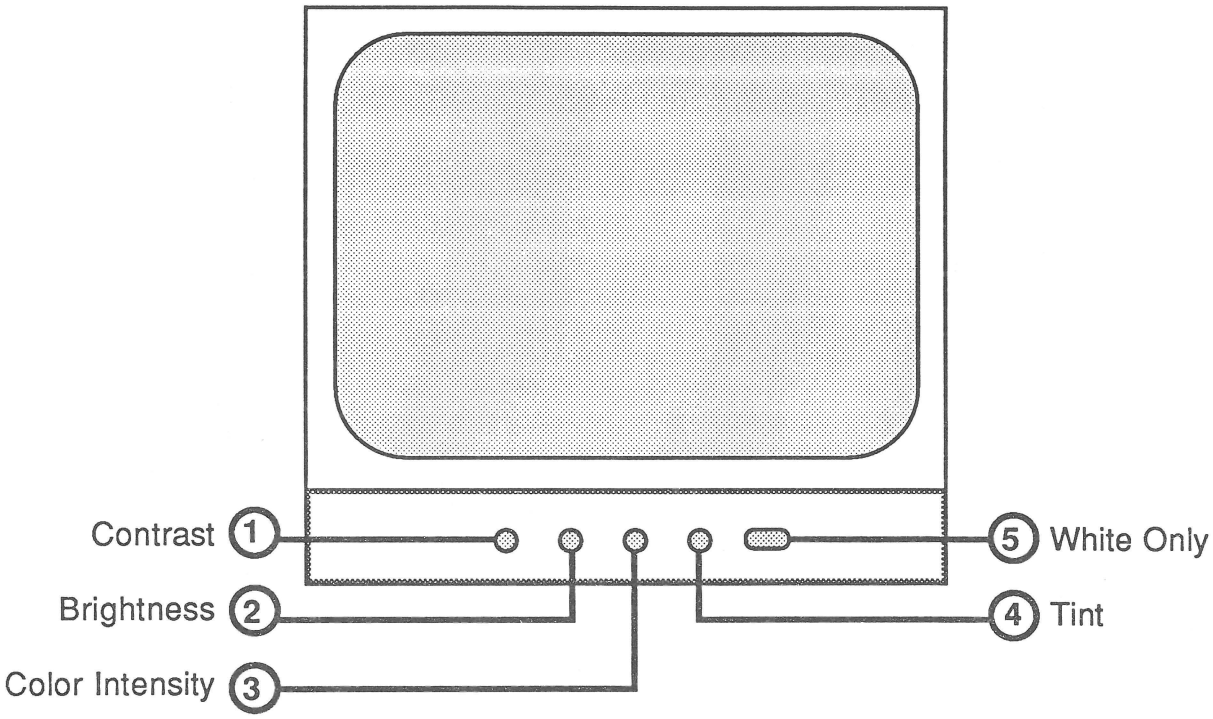


FIGURE 4

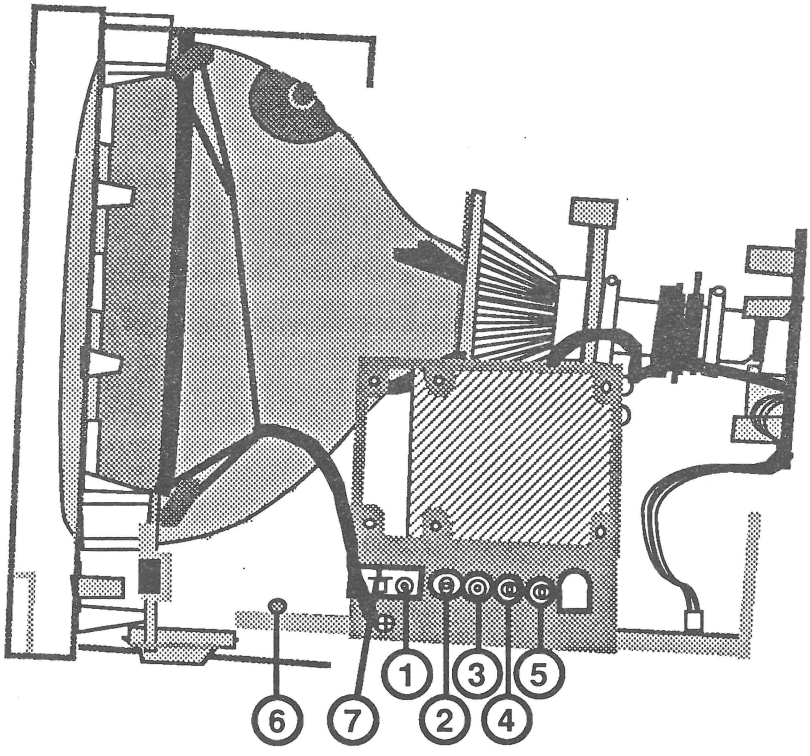


FIGURE 5

COLOR ADJUSTMENTS

Materials Needed

Apple ColorMonitor IIe/IIc
Apple IIe or IIc computer
Isolation transformer (for Series "H" Rev. B)
Apple II Peripherals Diskette
Small plastic flatblade screwdriver (tweaker)
   or plastic alignment tool
Mirror with prop (for viewing screen during adjustments)

Color Adjustment Procedure - Series "S"

1. Turn the monitor off and disconnect the power cord.

2. Disconnect the video cable from the back of the monitor.

3. Remove the rear cover. (See "Removing the Rear Cover" in the Series "S" Take-Apart section.)

4. Set the monitor on its feet, reconnect the power cord and video cable, and turn on the monitor and the computer.

5. Allow the monitor to warm up for at least 15 minutes.

6. Prop the mirror in front of the screen so that you can see the results of your adjustments as you work.

7. Turn the **COLOR INTENSITY** control (Figure 4, #3) on the front panel to its maximum counter-clockwise position.

8. Adjust the front panel **BRIGHTNESS** control (Figure 4, #2) to its detent (click) position.

9. Adjust the **CONTRAST** control (Figure 4, #1) to its maximum clockwise position.

10. Depress the **WHITE ONLY** switch (Figure 4, #5).

11. Locate the internal color controls behind the power supply board (Figure 5). **WARNING: THE POWER SUPPLY BOARD HAS EXTREMELY HIGH VOLTAGES. USE THE INSULATED TOOL IN ONE HAND ONLY, AND WATCH WHAT YOU ARE TOUCHING!**

12. Using the plastic alignment tool or insulated screwdriver, set the following controls to their mechanical centers:

    a. **R-DRIVE** (red) - Figure 5, #1

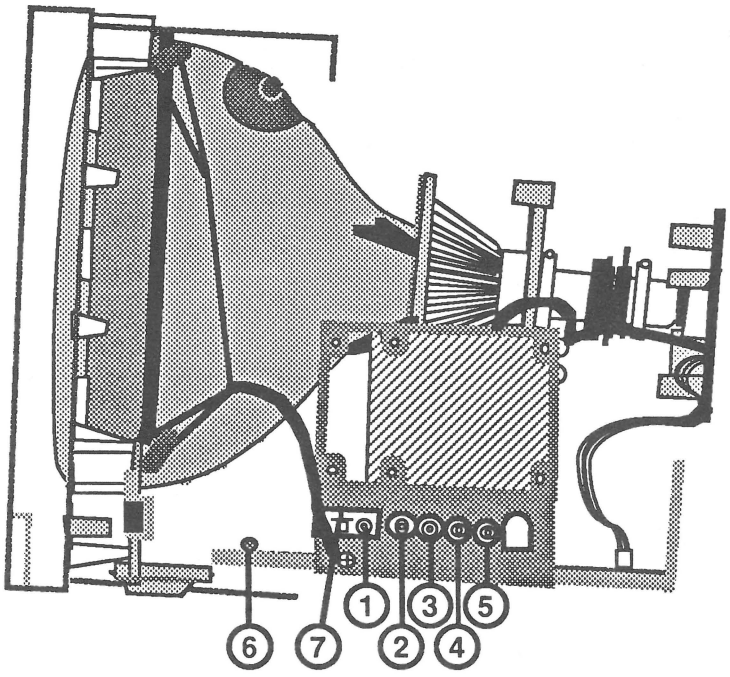


FIGURE 6

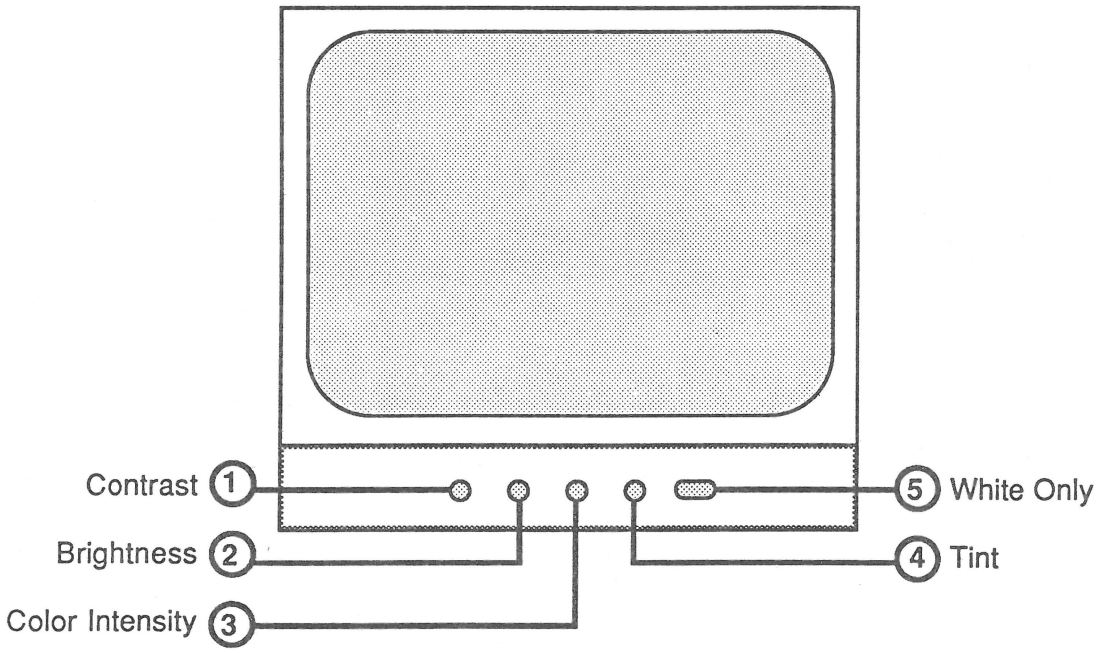


FIGURE 7

b. **B-DRIVE** (blue) - Figure 6, #2

c. **R-BIAS** (red) - Figure 6, #3

d. **G-BIAS** (green) - Figure 6, #4

e. **B-BIAS** (blue) - Figure 6, #5

f. **SUB-BRIGHTNESS** - Figure 6, #6

NOTE: To find mechanical center, turn the pot clockwise as far as possible, then counter-clockwise as far as possible. Mechanical center is exactly halfway between those two extremes.

13. Position the **SERVICE** switch (SW800) lever (Figure 6, #7) so that the lever points toward the picture tube at a 45° angle. The screen should now display a single horizontal line. Note the hue of the single horizontal line on the display screen. It must be adjusted so that it is white (neutral). No predominant color (red, blue, or green) should be visible. If the line is white, skip to step 16. However, if a predominant color is present within the horizontal line, proceed to step 14.

14. Make a slight counterclockwise adjustment to the **BIAS** control (red, green, or blue) that corresponds to the predominant color within the horizontal line.

15. Repeat step 14 until the horizontal line on the display screen is a neutral white.

16. Set the **SERVICE** switch (Figure 6, #7) back to its original position (with the lever pointing towards the back of the monitor).

17. Return the **WHITE ONLY** switch (Figure 7, #5) to its normal position (out).

18. Install the Apple II Peripherals Diskette into the drive and start up the program.

19. Select "Monitor Tests" from the main menu.

20. Select "Color Bars" from the monitor menu.

21. Adjust the **SUB-BRIGHTNESS** control (Figure 6, #6) so that the background on the display screen is black (no grain or grid is showing). Adjusting the **SUB-BRIGHTNESS** control in the clockwise direction increases the screen brightness level.

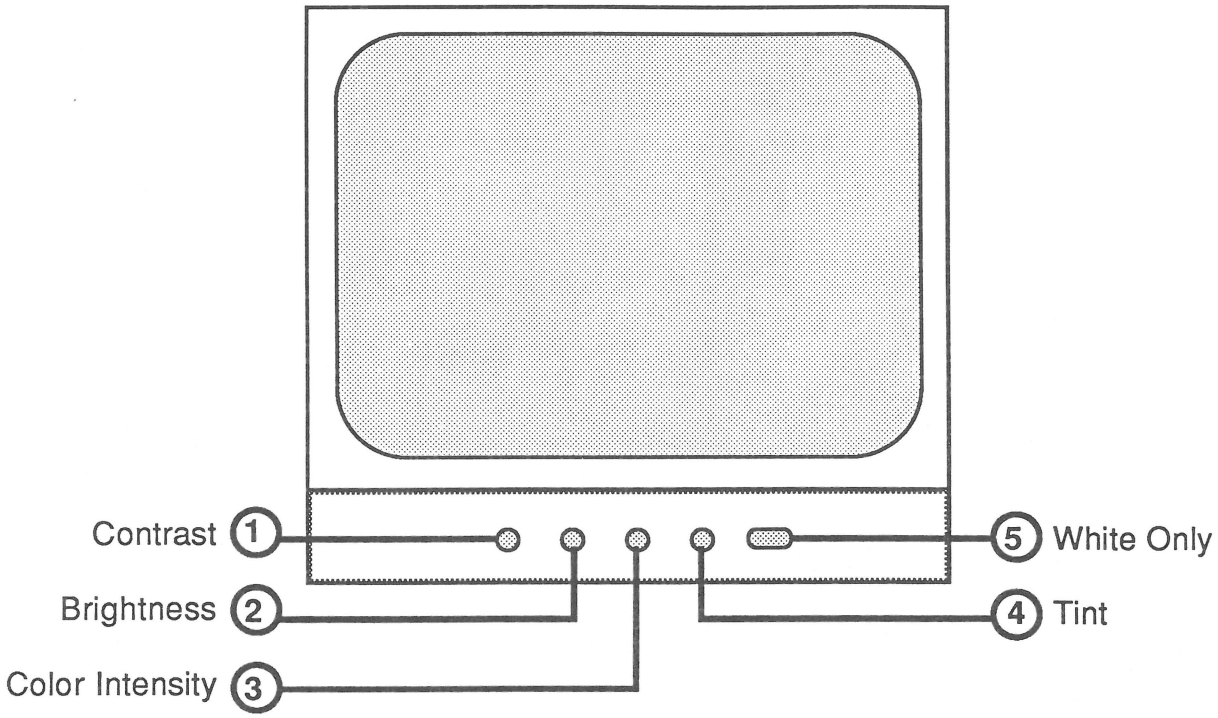

Contrast
1
Brightness
2
Color Intensity
3
5
White Only
4
Tint

FIGURE 8

22. Adjust the **COLOR INTENSITY** control (Figure 8, #3) and the **CONTRAST** control (Figure 8, #1) for optimum color viewing.

23. Adjust the **TINT** control (Figure 8, #4) until the yellow color bar is at its yellowest hue.

24. Turn off the monitor and the computer and disconnect the video cable and power cords.

25. Replace the rear cover. (See "Replacing the Rear Cover" in the Series "S" Take-Apart section.)

Color Adjustment Procedure - Series "H"

1. Turn the monitor off and disconnect the power cord.

2. Disconnect the video cable from the back of the monitor.

3. Remove the rear cover. (See "Removing the Rear Cover" in the Series "H" Take-Apart section.)

4. Set the monitor on its feet and reconnect the power cord and video cable. **(READ AND FOLLOW WARNING, p. 4.1.)**

5. Install the Apple II Peripherals Diskette in the drive and turn on the computer and the monitor.

6. Allow the monitor to warm up for at least 15 minutes.

7. Select "Monitor Tests" from the program's main menu.

8. Select "Color Bars" from the monitor menu.

9. Adjust the **CONTRAST** control (Figure 8, #1) to its full clockwise position.

10. Adjust the **BRIGHTNESS** control (Figure 8, #2) to its optimum viewing condition.

11. Press <ESCAPE> to return to the monitor menu.

12. Select "Full White Screen" from the monitor menu.

13. Adjust the **COLOR INTENSITY** control (Figure 8, #3) to its maximum counter-clockwise position.

14. Depress the **WHITE ONLY** switch on the front panel (Figure 8, #5).

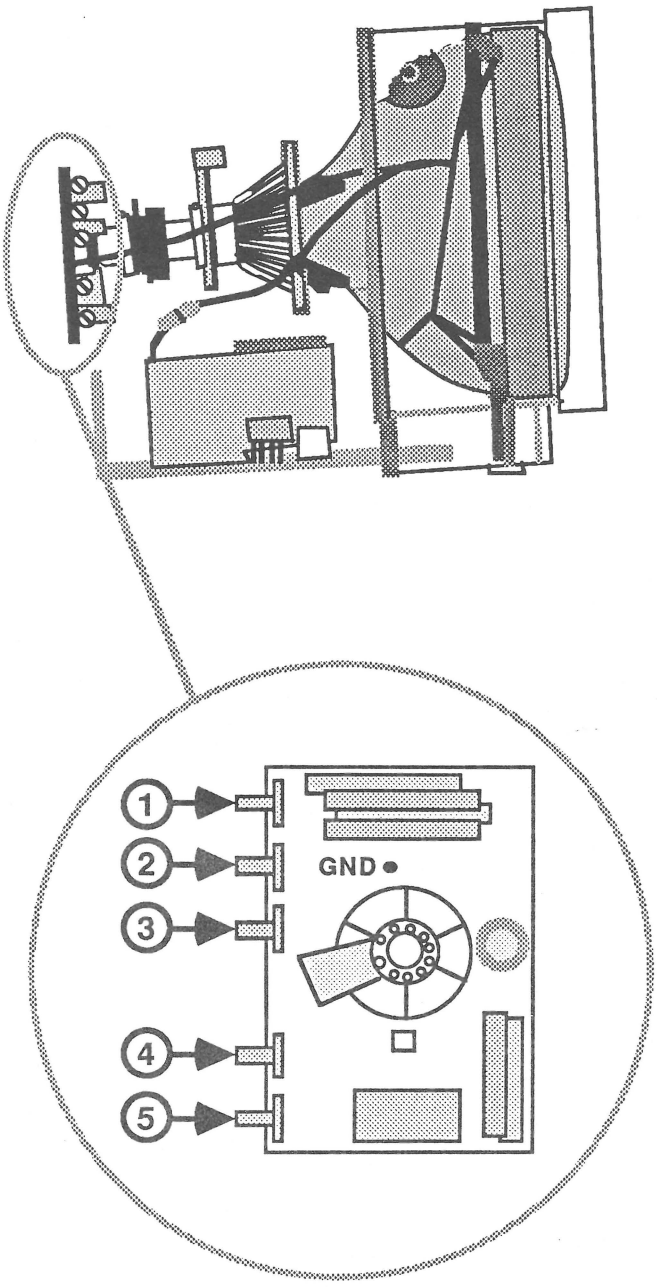


FIGURE 9

15. Locate the internal color controls on the CRT socket board (Figure 9).

    NOTE: The Series "H" monitors do NOT have a SERVICE switch.

16. **Using a plastic alignment tool or insulated screwdriver AND USING EXTREME CAUTION**, set the controls as follows:

    a. **B-DRIVE** (Figure 9, #1) - 1/2 clockwise position.

    b. **R-DRIVE** (Figure 9, #4) - 3/4 clockwise position.

    c. **B-BKG** (Figure 9, #2) - 1/2 clockwise position.

    d. **G-BKG** (Figure 9, #3) - 1/4 clockwise position.

    e. **R-BKG** (Figure 9, #5) - 1/2 clockwise position.

    NOTE: To set a pot at a given position, first find its mechanical center by turning clockwise as far as possible, then counter-clockwise as far as possible. Mechanical center is exactly halfway between those two extremes. The 1/4 clockwise position is halfway between the maximum counter-clockwise position and mechanical center; the 3/4 clockwise position is halfway between mechanical center and the maximum clockwise position.

17. Rotate the **B-DRIVE** control (Figure 9, #1) clockwise until the raster begins to appear bluish.

18. Rotate the **R-BKG** control (Figure 9, #5) to its 1/4 clockwise position, then rotate it clockwise until the raster just begins to show a reddish hue.

19. Alternately adjust the **B-BKG** and **G-BKG** controls (Figure 9, #2 and #3) until the raster is a grayish-white. No predominant color (red, blue, or green) should be visible. These controls should not have to be turned very far in the clockwise direction to achieve a neutral grayish-white raster.

20. Press <ESCAPE> to return to the monitor menu.

21. Select "Color Bars" from the monitor menu.

22. Return the **WHITE ONLY** switch (Figure 10, #5) to its normal position (out).

23. Adjust the front panel **COLOR INTENSITY** control (Figure 10, #3) until the raster displays the desirable amount of color.

24. Adjust the front panel **TINT** control (Figure 10, #4) so that the color block marked "Yellow" is at its yellowest hue.

25. Set the front panel **BRIGHTNESS** control (Figure 10, #2) so that the background behind the color bar pattern appears black.

26. Adjust the front panel **CONTRAST** control (Figure 10, #1) for optimum viewing comfort.

27. The color adjustment should now be within acceptable range. If not, repeat the adjustment procedure, beginning with step 9.

28. When color adjustment is correct, turn off the computer and monitor.

29. Disconnect the power cord and video cable.

30. Replace the rear cover. (See "Replacing the Rear Cover" in the "Series "H" Take-Apart section.)

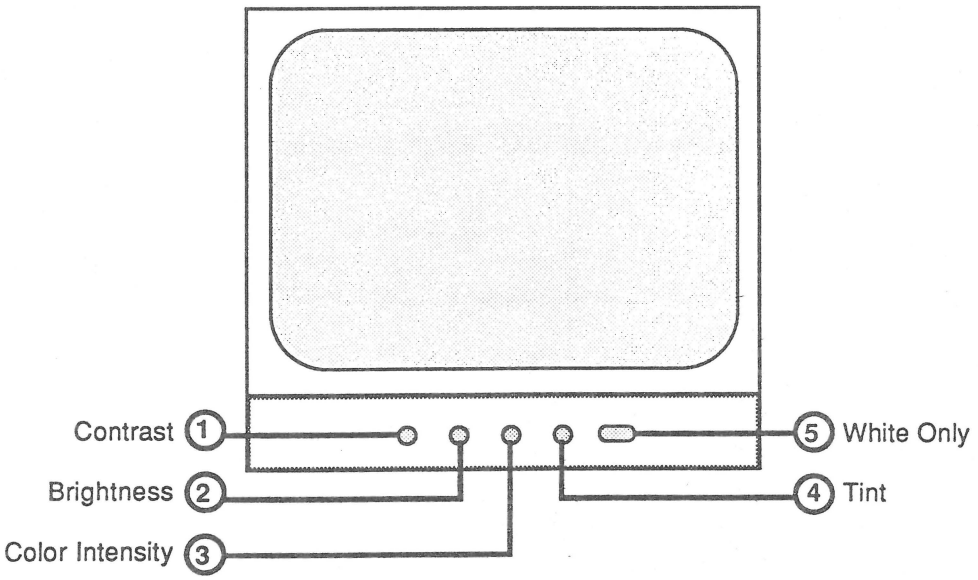


FIGURE 10

AppleColor Composite Monitor IIe/IIc and ColorMonitor IIe/IIc Technical Procedures

Section 5

Illustrated Parts List

The figures and lists below include all piece parts that can be purchased separately from Apple for the ColorMonitor IIe/IIc, along with their part numbers. These are the only parts available from Apple. Refer to your Apple Service Programs manual for prices.

Contents:

IIe Monitors:

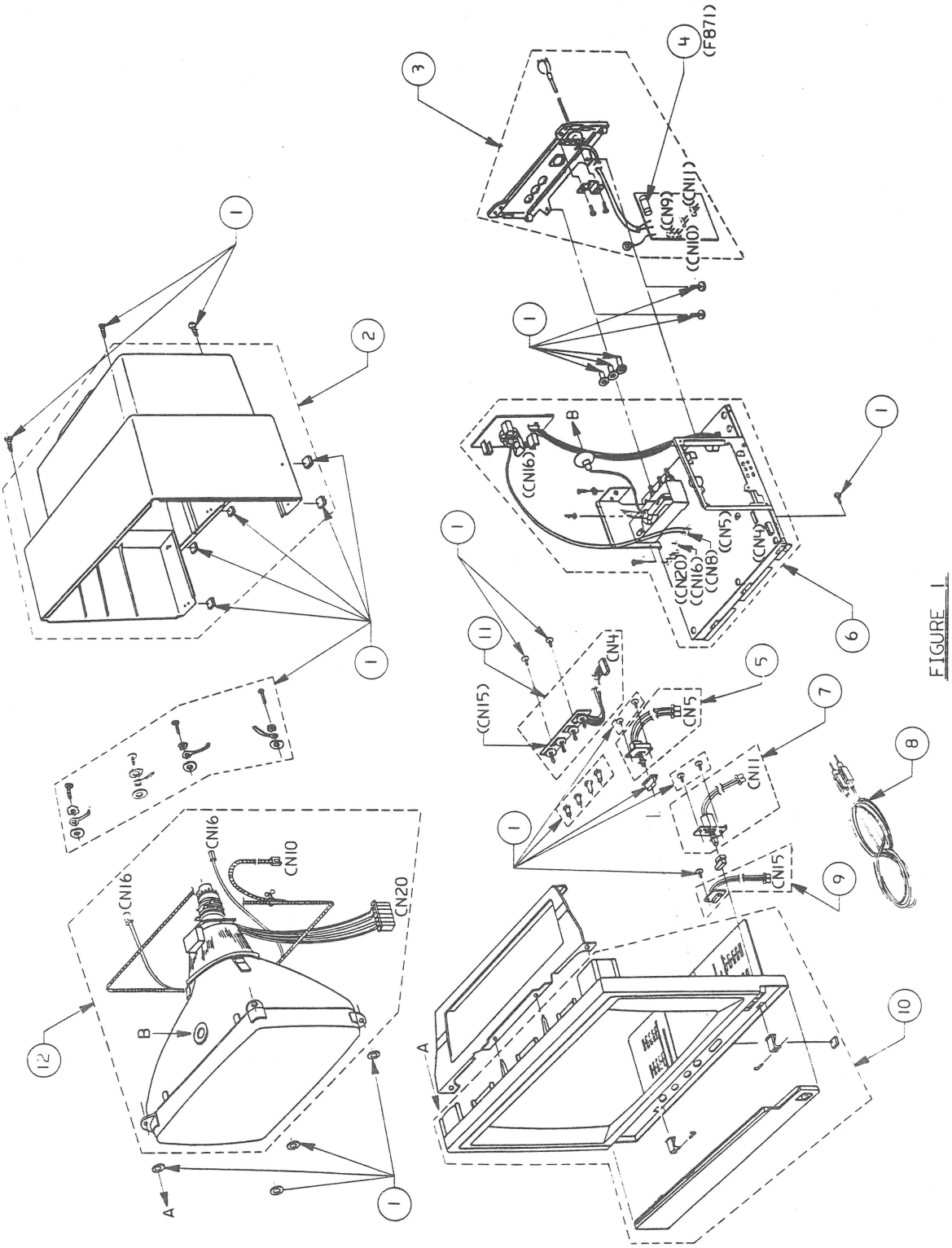
ColorMonitor IIe, Series "S".....5.3
AppleColor Composite Monitor IIe and ColorMonitor IIe, Series "H"..... 5.5

IIc Monitors:

AppleColor Composite Monitor IIc and ColorMonitor II, Series "S"..... 5.7
ColorMonitor IIc, Series "H"..... 5.9

Packaging:

Series "H" Monitors - Packaging.....5.11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CN16
CN10
CN20
A
B

FIGURE 1

COLORMONITOR IIe, SERIES "S" (Figure 1)

Item	Part No.	Description
1	956-0001	Screw/Knob Set, ColorMonitor-S
2	949-0019	Rear Cover, ColorMonitor IIe-S
3	970-1278	PS/Panel/AC Cord Assembly, IIe 110V-S
4	740-0102	Fuse, 3 Amp, 3AG, 250V Slow Blow
5	937-0005	Switch, White Only, ColorMonitor IIe,c-S
6	661-0308	Main Logic Board, ColorMonitor IIe and IIc-S
7	937-0006	On/Off Switch, ColorMonitor 110V-S
8	590-0539	Video Cable, Smoke
9	930-0001	LED Assembly, ColorMonitor IIe-S
10	949-0017	Bezel, ColorMonitor IIe-S
11	970-1277	Control PCB, ColorMonitor IIe,c-S
12	076-0173	CRT Assembly, ColorMonitor IIe,c-S

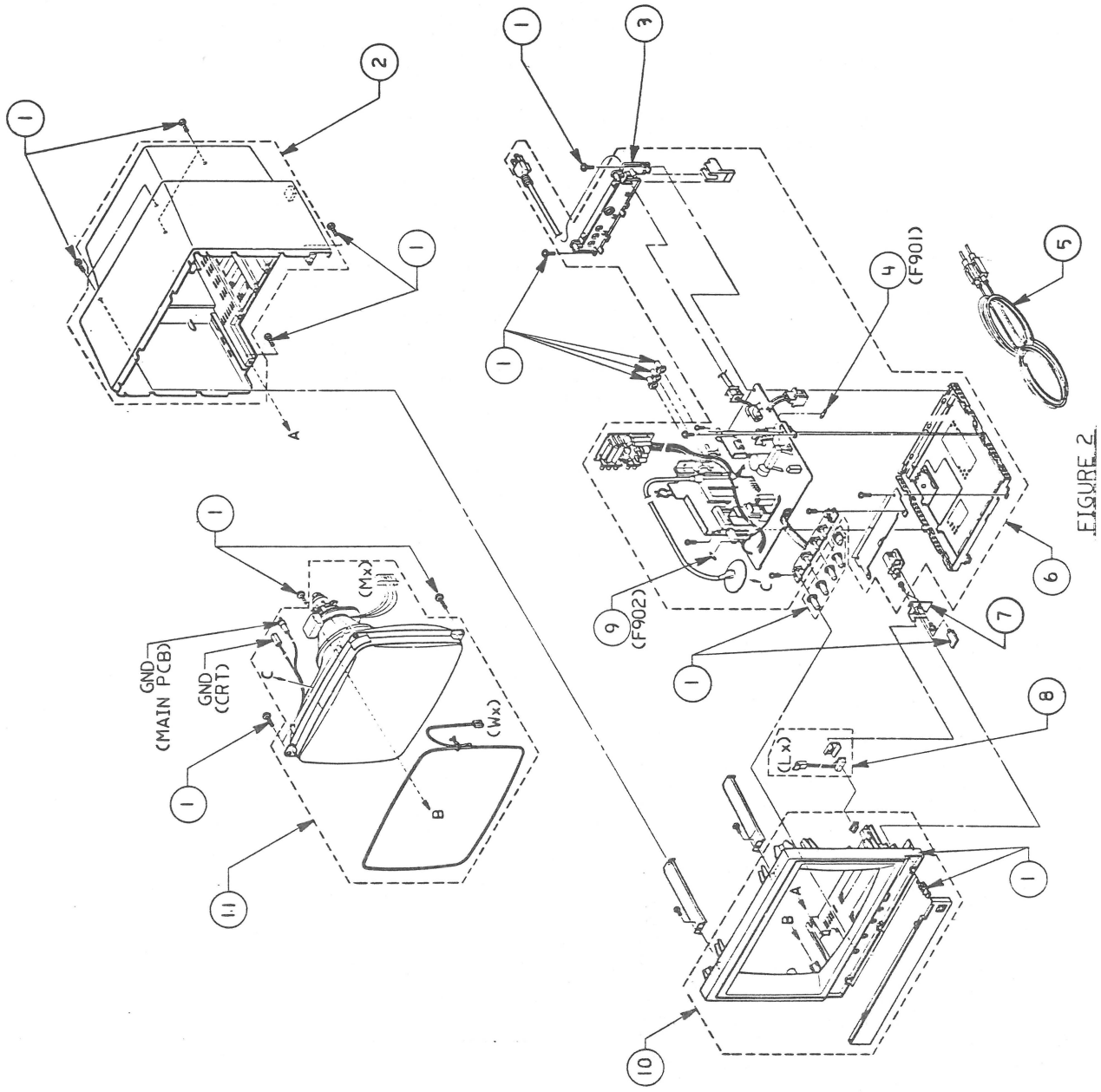
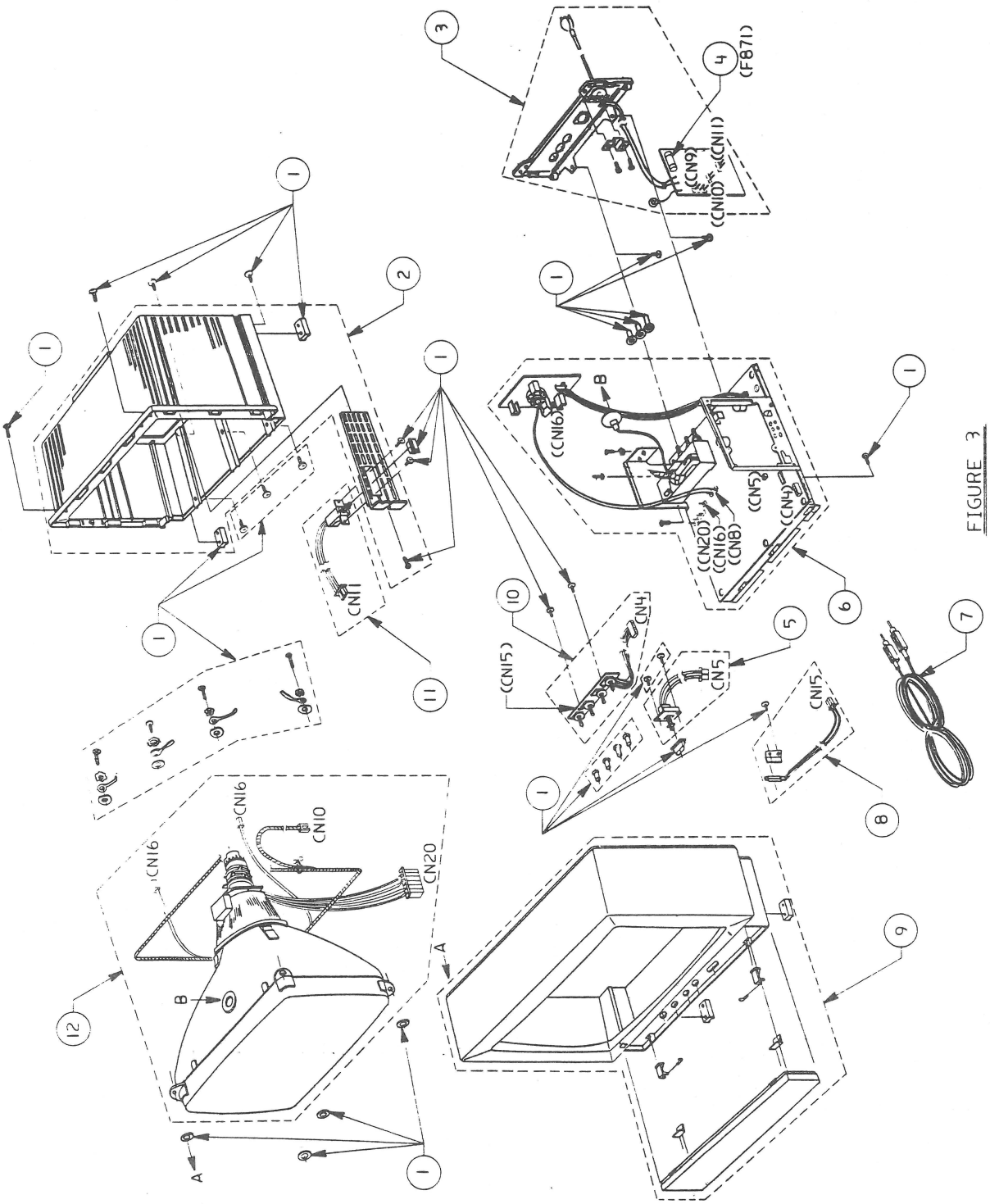


FIGURE 2

APPLECOLOR COMPOSITE MONITOR IIe/COLORMONITOR IIe, SERIES "H" (Figure 2)

Item	Part No.	Description
1	956-0002	Screw/Knob Set, ColorMonitor-H, Beige
	956-0005	Screw/Knob Set, Composite Monitor IIe-H, Platinum
2	949-0025	Rear Cover, ColorMonitor IIe-H, Beige
	949-0082	Rear Cover, Composite Monitor IIe-H, Platinum
3	949-0103	Rear Panel, Composite Monitor IIe-H, Platinum
4	740-0401	Fuse, Medium Time Lag, 4A, 125V
5	590-0539	Video Cable, Smoke
6	661-0317	Main Logic Board, ColorMonitor IIe-H and IIc-H, Composite IIe-H
7	948-0016	Switch Bracket, ColorMonitor IIe-H, Composite IIe-H
8	930-0003	LED Assembly, ColorMonitor IIe,c-H, Composite IIe-H
9	740-0304	Fuse, 1 Amp, Fast Blow
10	949-0023	Bezel, ColorMonitor IIe-H, Beige
	949-0081	Bezel, Composite IIe-H, Platinum
11	076-0194	CRT Assembly, ColorMonitor IIe,c-H, Composite IIe-H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B
1
2
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4
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10
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12

FIGURE 3

APPLECOLOR COMPOSITE MONITOR IIc/COLORMONITOR IIc, SERIES "S" (Figure 3)

Item	Part No.	Description
1	956-0001	Screw/Knob Set, ColorMonitor-S, Beige
	956-0006	Screw/Knob Set, Composite Monitor IIc-S, Platinum
2	949-0020	Rear Cover, ColorMonitor IIc-S
3	970-1279	PS/Panel/AC Cord Assembly, ColorMonitor IIc, 110V
	970-1305	PS/Panel/AC Cord Assembly, Composite IIc, 110V
4	740-0102	Fuse, 3 Amp, 3AG, 250V Slow Blow
5	937-0005	Switch, White Only, ColorMonitor IIe,c-S
6	661-0308	Main Logic Board, ColorMonitor IIe and IIc-S, Composite IIc-S
7	590-0539	Video Cable, Smoke
8	930-0002	LED Assembly, ColorMonitor IIc-S, Composite IIc-S
9	949-0018	Bezel, ColorMonitor IIc-S, Beige
	949-0077	Bezel, Composite Monitor IIc-S, Platinum
10	970-1277	Control PCB, ColorMonitor IIe,c-S, Composite IIc-S
11	937-0006	On/Off Switch, ColorMonitor 110V-IIe/IIc-S, Composite IIc-S
12	076-0173	CRT Assembly, ColorMonitor IIe,c-S, Composite IIc-S

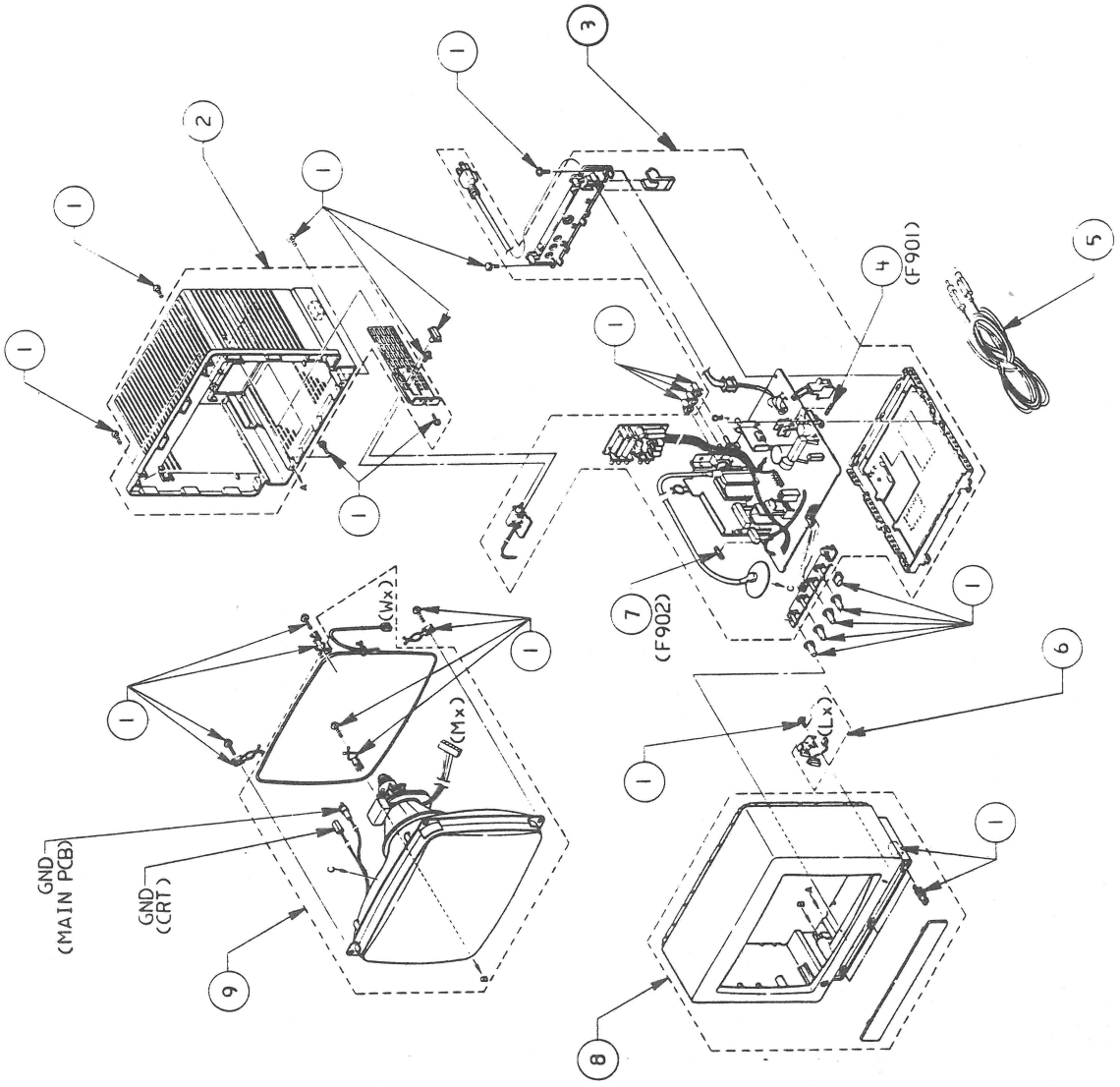

FIGURE 4

COLORMONITOR IIc, SERIES "H" (Figure 4)

Item	Part No.	Description
1	956-0002	Screw/Knob Set, ColorMonitor-H
2	949-0026	Rear Cover, ColorMonitor IIc-H
3	661-0317	Main Logic PCB, IIe and IIc-H
4	740-0401	Fuse, Medium Time Lag, 4A, 125V
5	590-0539	Video Cable, Smoke
6	930-0003	LED Assembly, ColorMonitor IIe,c-H
7	740-0304	Fuse, 1 Amp, Fast Blow
8	949-0024	Bezel, ColorMonitor IIc-H
9	076-0194	CRT Assembly, ColorMonitor IIe,c-H

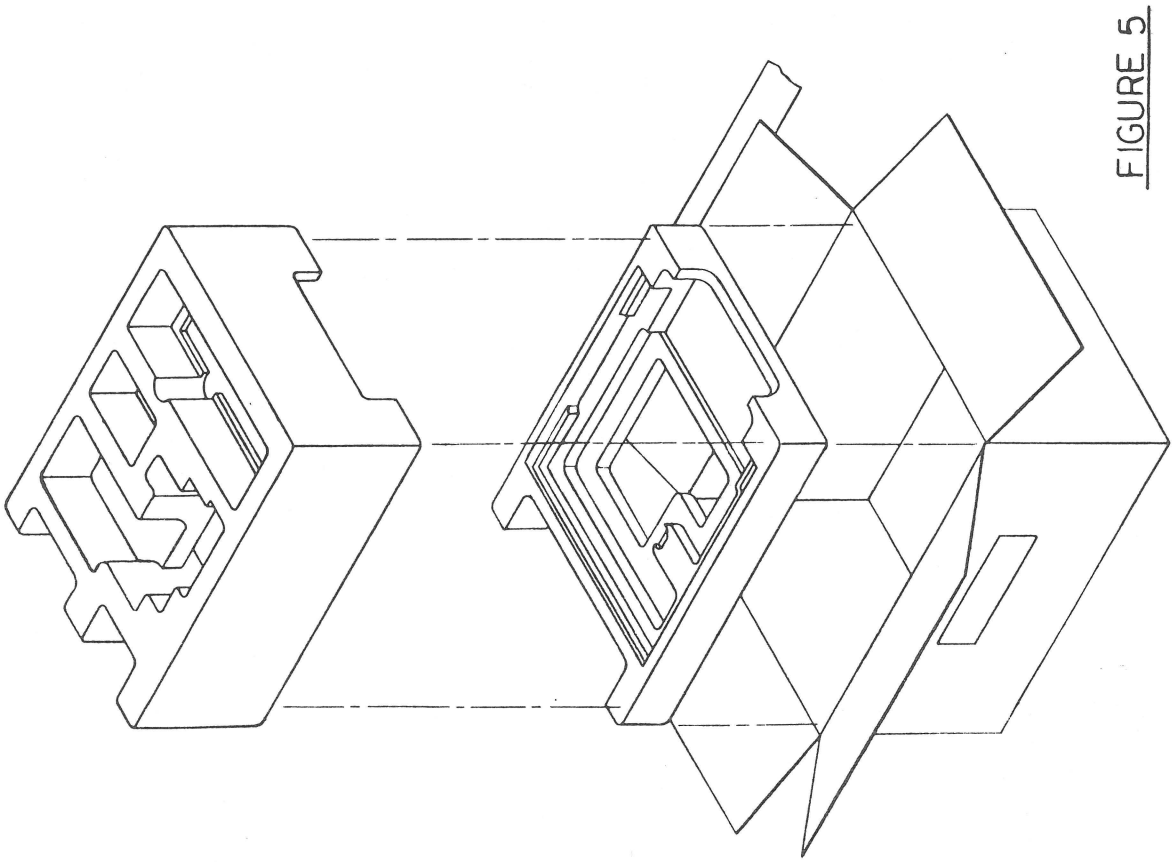

FIGURE 5

SERIES "H" MONITORS - PACKAGING (Figure 5)

Part No.	Description
602-0154	Packaging, ColorMonitor IIe/IIc-H, Composite IIe-H

Apple Technical Procedures

AppleColor RGB Monitor

Technical Procedures

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	2.5	Discharge Procedure
	2.6	Anode Cap
	2.7	Switch Panel Controls
	2.10	CRT Video Board
	2.14	Main Logic (Power Supply) Board
	2.19	AC Cord Assembly
	2.20	Cathode-Ray Tube (CRT)
	2.24	LED Assembly
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	3.3	Important Safety Tips
	3.4	Pre-Adjustment Set-Up Procedure
	3.6	Vertical Adjustments
	3.7	Horizontal Adjustments
	3.9	Linearity Adjustments
	3.9	Focus Adjustments
	3.11	Color Adjustments
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	4.2	Important Terms
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...Continued on next page

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4.3 Set-Up
4.4 To Select a Test
4.4 To Deselect a Test
4.4 Perform Adjustment Checks
4.5 Geometric Display Checks
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Apple Technical Procedures

AppleColor RGB Monitor

Section 1 – Basics

❑ CONTENTS

1.2 Product Description
1.2 RGB Color Signal
1.2 Location of Controls

❑ PRODUCT DESCRIPTION

RGB Color Signal

The AppleColor™ RGB Monitor is a 12-inch display monitor operated with individual red, green, and blue video input signals. It uses a DB-15 connector and cable to carry these and synchronization signals from the computer's video output jack.

Location of Controls

The power switch and the brightness and contrast controls for the AppleColor RGB are on the right side of the case near the top (Figure 1).

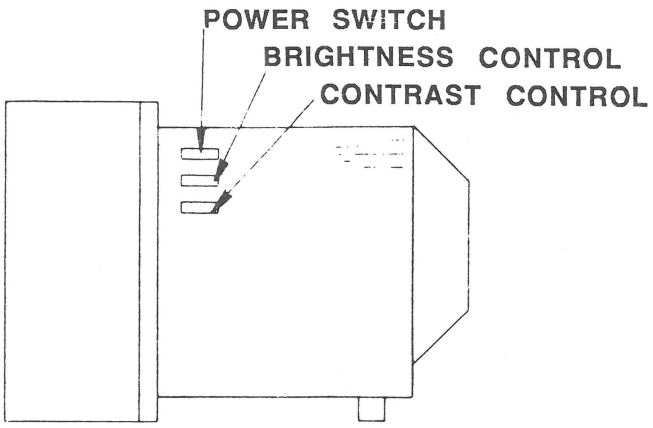

FIGURE 1

Less frequently used controls are at the back of the monitor (Figure 2).

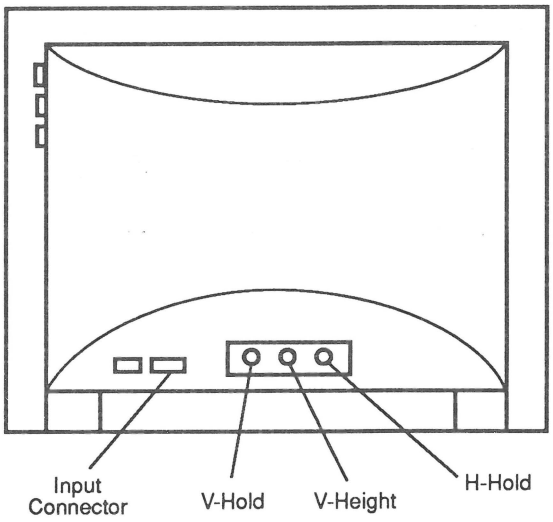

FIGURE 2

Internationally recognized symbols, shown in Figure 3, are used to identify the various controls.

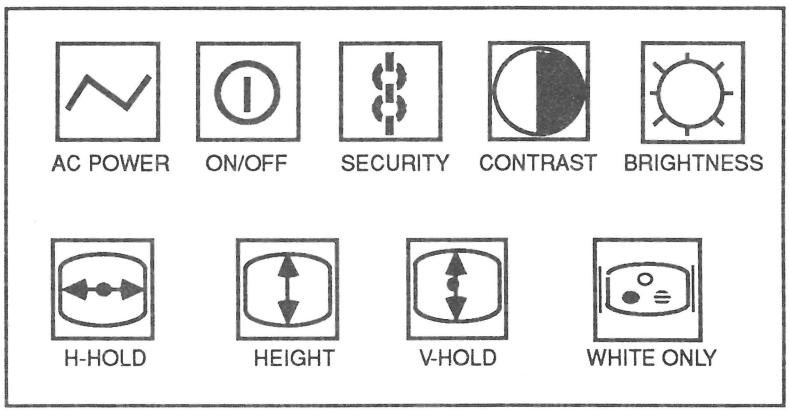

FIGURE 3

The AppleColor RGB Monitor contains a cathode-ray tube (CRT), which operates at very high voltages and contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself), scattering glass in all directions.

WARNING: Before working inside this monitor, read Section 8, CRT Safety, under the* You Oughta Know *tab.

Apple Technical Procedures

AppleColor RGB Monitor

Section 2 – Take-Apart

❑ CONTENTS

2.2 Rear Cover
2.5 Discharging the Cathode-Ray Tube (CRT)
2.5 Discharge Procedure
2.6 Anode Cap
2.7 Switch Panel Controls
2.10 CRT Video Board
2.14 Main Logic (Power Supply) Board
2.19 AC Cord Assembly
2.20 Cathode-Ray Tube (CRT)
2.24 LED Assembly
2.26 Main Logic Board Fuse

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in this section.

IMPORTANT: *The module referred to throughout these procedures as the "main logic board" is designated as the "power supply board" in the Illustrated Parts List and in the Price Pages of the Apple Service Programs Manual.*

❑ REAR COVER

WARNING: *The AppleColor RGB Monitor contains high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the* You Oughta Know *tab before you remove the back cover.* ***Failure to follow the safety rules could result in serious injury.***

Materials Required

Medium Phillips screwdriver

Remove

1. Turn the monitor off and disconnect the power cord.
2. Disconnect the video cable from the back of the monitor.
3. Carefully set the monitor on its face (screen side) so that the back is facing up.

Note: The AppleColor RGB Monitor contains sensitive components that can be damaged by rough treatment. Whenever it is necessary to turn the monitor over, be sure to rest it on a protective pad.

4. Remove the four screws (Figure 1, #1) from the rear of the monitor.

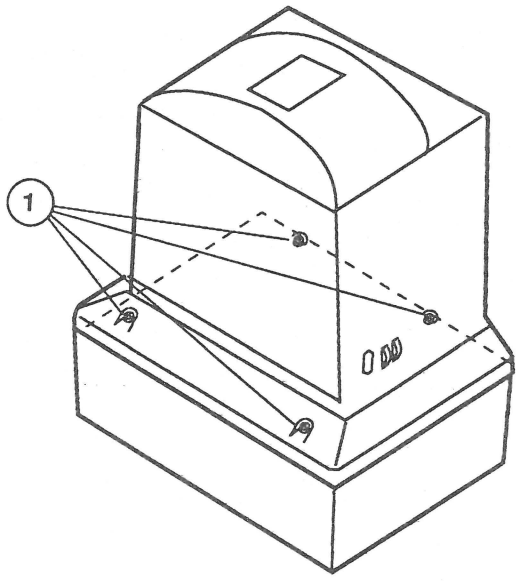

FIGURE 1

5. Carefully set the monitor upright. The switch panel on the right-front side of the rear cover is plugged into the main logic board and the CRT video board, so the rear cover cannot be totally removed until these cables are unplugged.

6. Gently pull the rear cover out about eight inches until connector S3 on the main logic board is easily accessible (Figure 2, #1). Unplug connector S3 at the main logic board.

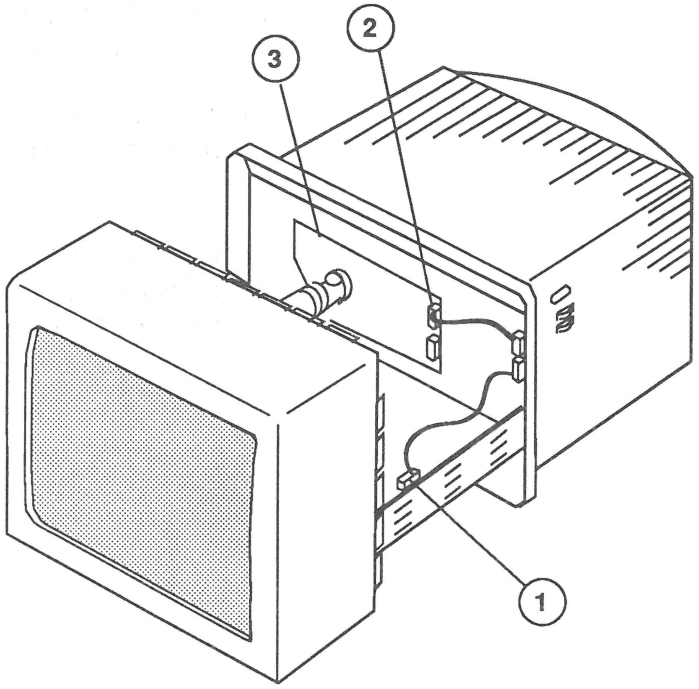

FIGURE 2

7. Carefully pull the rear cover out another six inches until the CRT video board is easily accessible (Figure 2, #2). Unplug connector VC (Figure 2, #3) at the CRT video board.

8. Pull the AC power cord through the opening in the rear cover, and set the rear cover aside.

Replace

1. Guide the AC power cord through the opening in the rear cover. Slide the cover onto the monitor, leaving the CRT video board (Figure 2, #2) accessible, as shown in Figure 2.

2. Install the brightness and contrast controls cable into connector VC on the CRT video board (Figure 2, #3).

3. Slide the rear cover on the monitor another six inches and install the ON/OFF switch cable into connector S3 (Figure 2, #1); then slide the cover on the rest of the way.

4. Carefully position the monitor face down, and install the four screws (Figure 1, #1) at the back of the monitor.

5. Perform the Adjustments Check procedure in the Troubleshooting section to verify that the monitor is functioning properly.

❑ DISCHARGING THE CATHODE RAY TUBE (CRT)

Materials Required

Safety goggles
Foam pad (ungrounded)
Needlenose pliers
Alligator lead
New CRT discharge tool (part number **076-0381**)

WARNING: Before starting, read the safety precautions and the CRT discharge procedure in Section 8, CRT Safety, under the* You Oughta Know *tab. *Alternative instructions for discharging the CRT using the older version of the discharge tool (and/or a screwdriver) are given in that section.*

Discharge Procedure

1. **Remove your grounding wriststrap and jewelry and put on safety goggles before beginning!**

2. Remove the rear cover.

3. Set the monitor upright on the ungrounded foam pad, with the back facing you.

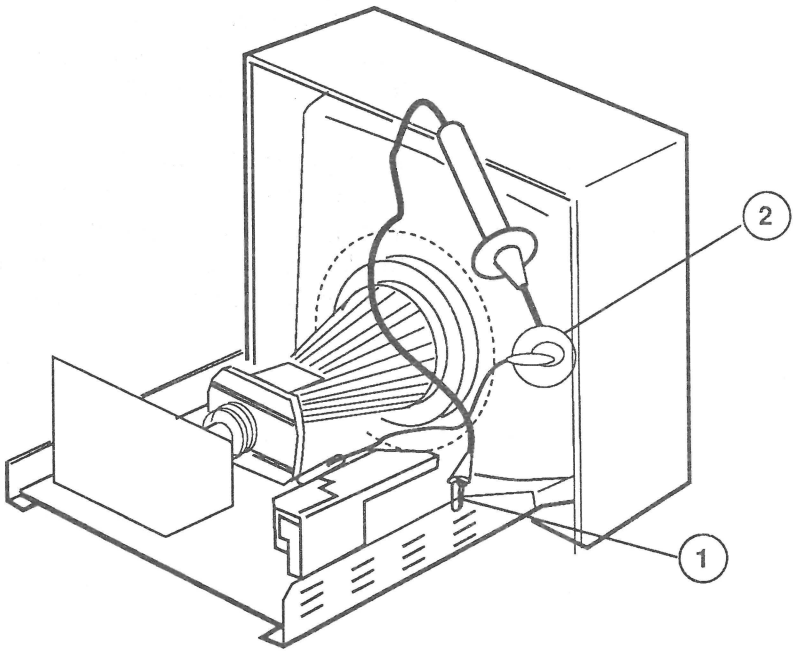

FIGURE 3

4. Attach the clip of the CRT discharge tool to any metal part of the chassis (Figure 3, #1).

5. Put one hand behind your back, and grasp the handle of the discharge tool with your other hand.

WARNING: *Use only one hand when discharging the CRT to prevent forming a path of current through your body should your hand slip and touch the metal part of the discharge tool during the discharge procedure.*

6. Hold the CRT discharge tool to the tube surface, and insert its probe under the anode cap (Figure 3, #2) until it touches the anode ring.

7. Remove the probe of the CRT discharge tool from under the anode cap and detach its clip from the metal chassis.

Note: A secondary charge could build up over time, even after you have discharged the CRT. To dissipate any residual charge, establish an ongoing ground by clipping one end of an alligator lead to the chassis frame and the other end to the anode ring or aperture.

Anode Cap

For some procedures, you may have to remove the anode cap. After you have discharged the CRT, peel back the anode cap until you can see the anode "ring" (or connector) at the center. Using needlenose pliers, compress the two prongs on the connector to free it from the anode aperture.

To replace the anode cap, press together the two prongs of the anode connector so that you can insert it into the aperture. Tug on the anode wire to make sure it is firmly seated, and then press down around the edges of the rubber anode cap to ensure a firm seal.

❑ SWITCH PANEL CONTROLS

Materials Required

Medium Phillips screwdriver
Small flathead screwdriver
Small diagonal cutters
Small crescent wrench (thin-jawed pliers will do)
Small cable ties

Remove

1. Turn off the monitor and disconnect the AC cord.
2. Remove the rear cover. (See "Removing the Rear Cover.)
3. **DISCHARGE THE CRT** if it hasn't already been discharged. (See "Discharging the Cathode Ray Tube [CRT].")

Switch Panel

4. Remove the screw (Figure 4, #1) that secures the switch panel to the rear cover, and then remove the switch panel.

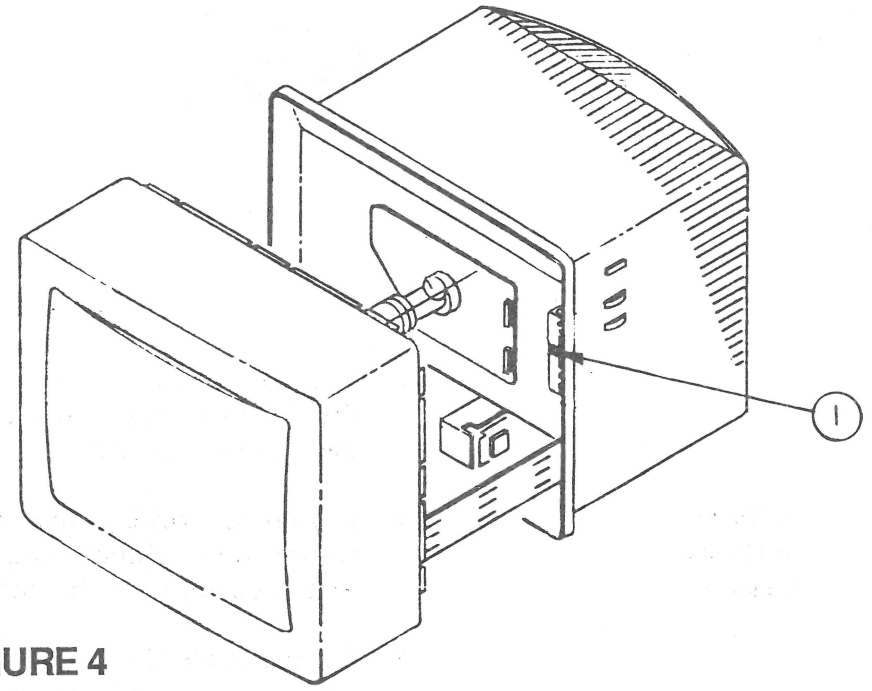

FIGURE 4

On/Off Switch

5. Locate the plastic ON/OFF switch button on the switch panel (Figure 5, #1) and pull it off the ON/OFF switch shaft. If necessary, use the small flathead screwdriver to pry off the switch.

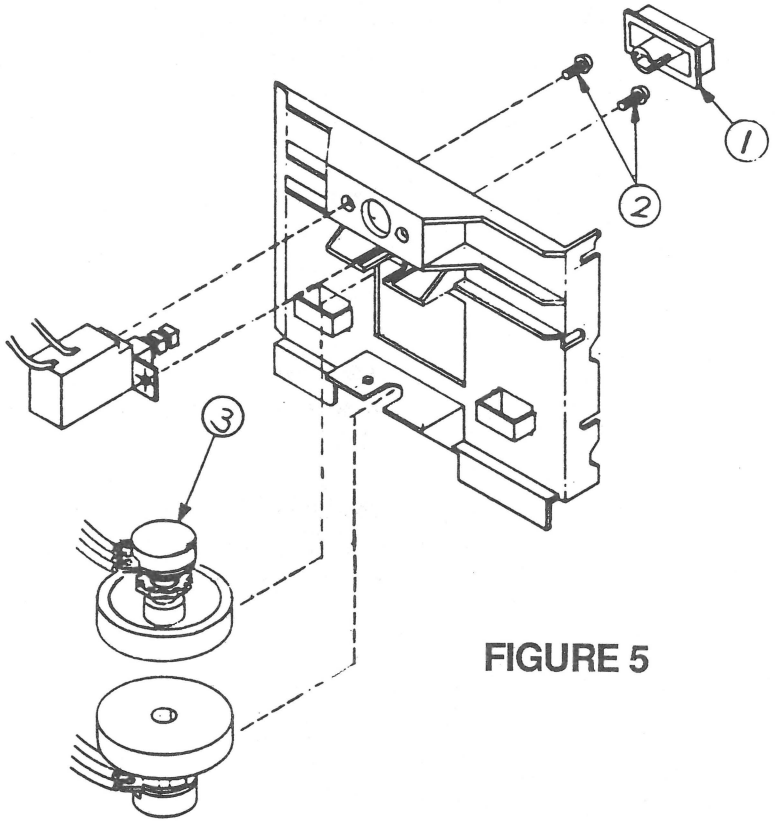

FIGURE 5

6. Remove the two screws (Figure 5, #2) that secure the ON/OFF switch to the switch panel, and remove the ON/OFF switch.

Brightness and Contrast Controls

7. Loosen the locking nuts (Figure 5, #3), that secure the brightness and contrast controls to the switch panel, until the controls can be removed.

8. Cut the cable ties with the diagonal cutters, and remove the brightness and contrast controls from the switch panel.

Replace

Brightness and Contrast Controls

1. Replace the brightness and contrast control potentiometers so that their metal tabs are inserted into their cutouts on the switch panel, and tighten the locking nuts (Figure 5, #3) that secure them to the switch panel.

2. Push the plastic brightness and contrast control thumbwheels onto their shafts as far as possible toward their respective potentiometers.

On/Off Switch

3. Replace the two screws (Figure 5, #2) that secure the ON/OFF switch to the switch panel.

4. Replace the switch button (Figure 5, #1).

Switch Panel

5. Install the screw (Figure 4, #1) that secures the switch panel to the rear cover.

6. Install the notches at the rear of the switch panel into the plastic retaining slots on the rear cover.

7. Install cable ties to secure the ON/OFF switch and brightness and contrast control cables to the switch panel.

8. Replace the rear cover. (See "Rear Cover.")

❑ CRT VIDEO BOARD

Materials Required

40-watt soldering iron, solder, and solder sucker
Medium Phillips screwdriver
Sharp diagonal cutters or X-acto knife
RTV or silicon glue
Small cable ties

Remove

1. Remove the rear cover.

2. Discharge the CRT if you haven't already done so.

3. Use an X-acto knife or a pair of sharp diagonal cutters to carefully cut off the silicon glue that holds the CRT video board to the CRT neck (see Figure 6).

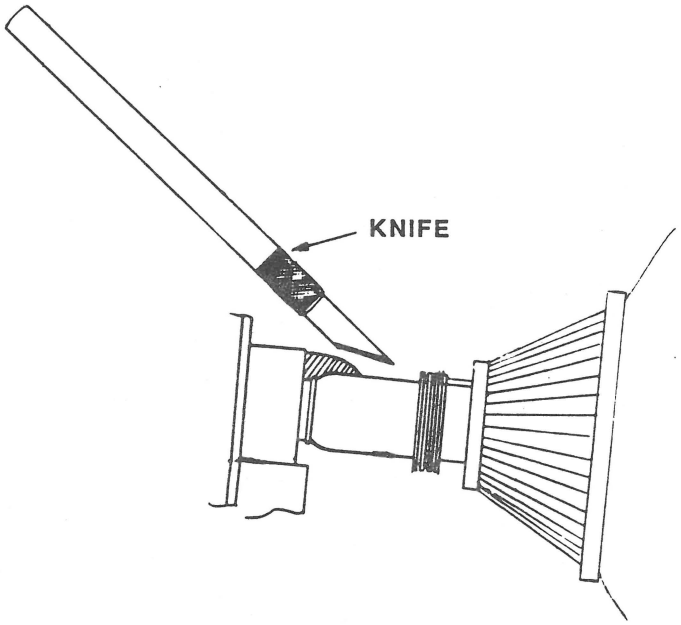

FIGURE 6

4. Cut any cable ties that prevent the CRT video board from being removed.

5. Slip the CRT video board off the CRT (see Figure 7).

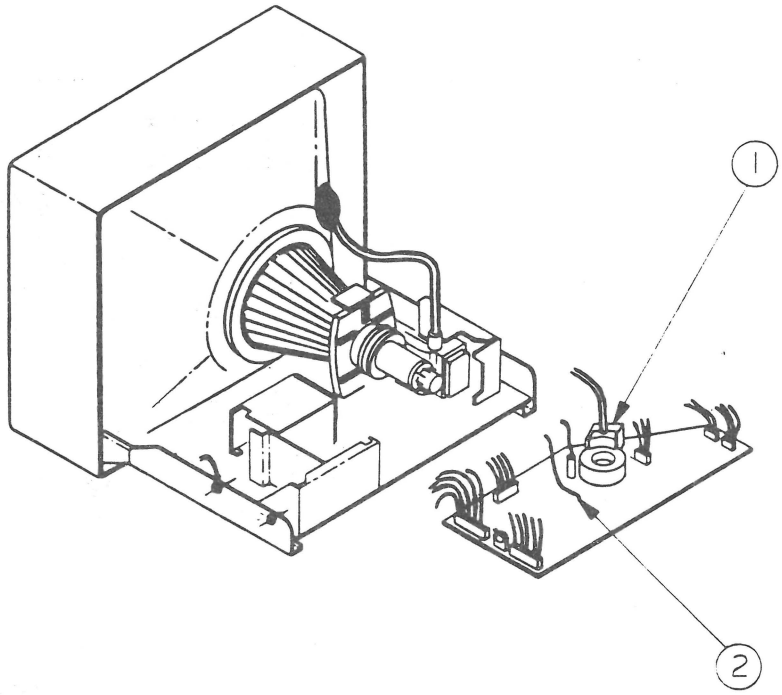

FIGURE 7

6. Remove the plastic shield (Figure 7, #1) covering the focus wire (black) terminal. Desolder the focus wire from the terminal.

7. Desolder the screen wire (gray) from the SC terminal on the CRT video board (Figure 7, #2).

   Note: Gently pull on the wire from the component side of the board while you hold the soldering iron tip against the wire's terminal on the noncomponent side of the board. When the solder liquifies, the wire should come through.

WARNING: *Do not leave the soldering iron tip on the wire's terminal too long, or the board may be damaged.*

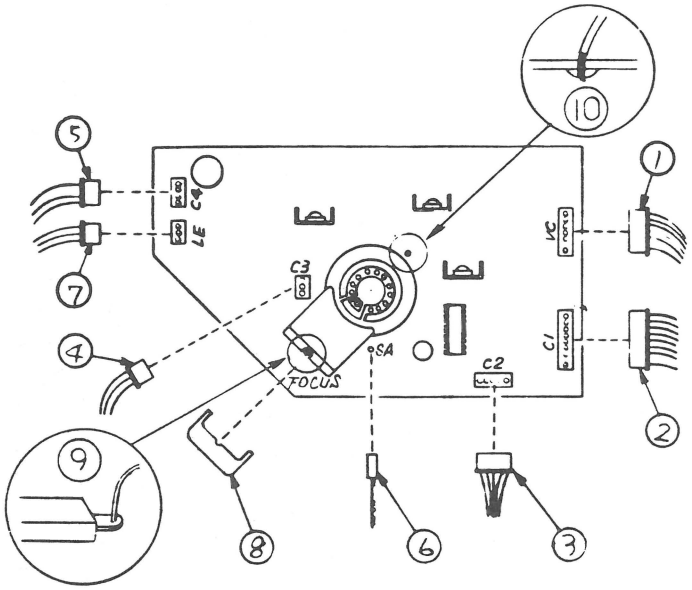

FIGURE 8

8. Unplug these connectors from the CRT video board:

- VC Figure 8, #1 (to the main logic board)
- C1 Figure 8, #2 (to the main logic board)
- C2 Figure 8, #3 (to the main logic board)
- C3 Figure 8, #4 (to the main logic board)
- C4 Figure 8, #5 (to the main logic board)
- SA Figure 8, #6 (ground wire around the CRT)
- LE Figure 8, #7 (to the LED assembly)

Replace

1. Solder the focus wire (black) to the terminal on the CRT video board (Figure 8, #9). Replace the plastic shield (Figure 8, #8).

2. Solder the screen wire (gray) to the SC terminal on the CRT video board (Figure 8, #10).

3. Connect the following CRT video board connectors:

   - VC Figure 8, #1 (to the main logic board)
   - C1 Figure 8, #2 (to the main logic board)
   - C2 Figure 8, #3 (to the main logic board)
   - C3 Figure 8, #4 (to the main logic board)
   - C4 Figure 8, #5 (to the main logic board)
   - SA Figure 8, #6 (ground wire around the CRT)
   - LE Figure 8, #7 (to the LED assembly at the front of the monitor)

4. Install the CRT video board on the CRT neck.

5. Where appropriate, route cables through the plastic cable standoffs, and secure them to the CRT video board with cable ties.

6. Apply the silicon glue to secure the CRT video board to the end of the CRT neck (Figure 6).

7. Replace the rear cover.

❑ MAIN LOGIC (POWER SUPPLY) BOARD

Materials Required

40-watt soldering iron, solder, and solder sucker
Medium Phillips screwdriver
Sharp diagonal cutters
RTV or silicon glue
Small cable ties
Small pliers with thin jaws

IMPORTANT: *The module referred to throughout these procedures as the "main logic board" is designated as the "power supply board" in the Illustrated Parts List and in the Price Pages of the Apple Service Programs Manual.*

Remove

1. Remove the rear cover.
2. **Discharge the CRT.**

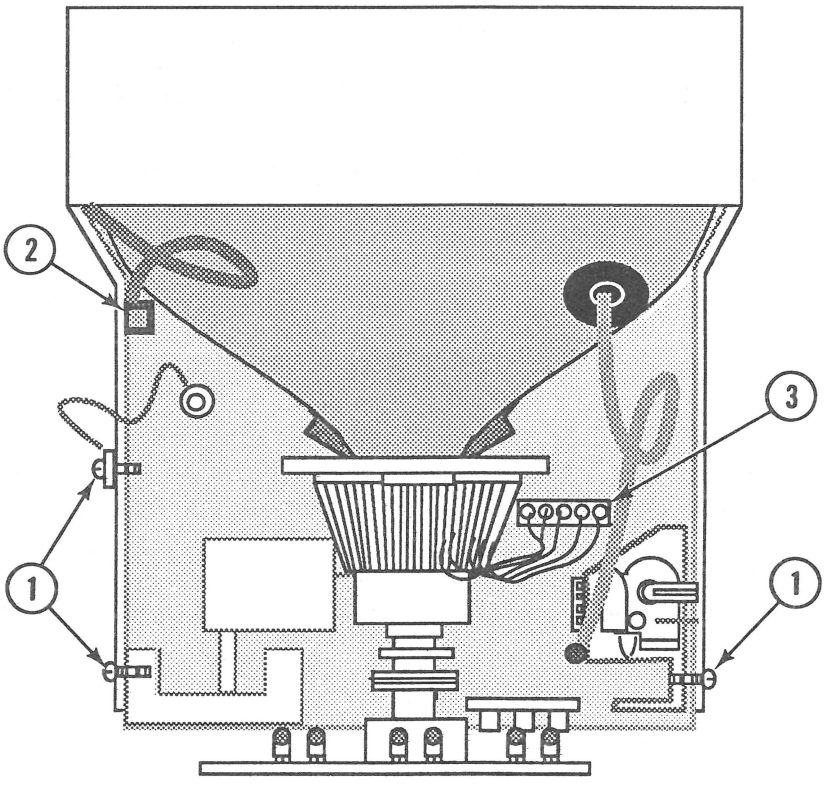

FIGURE 9

3. If the main logic board is the module being replaced, remove the CRT video board. If the main logic board is being removed to get at something else, leave the CRT video board installed, but unplug connectors SA and LE on the CRT video board, and cut any cable ties that restrict their removal.

4. Carefully unplug connector PC (Figure 9, #2).

5. If the main logic board is the module that is being replaced, remove the AC power cord receptacle. If the main logic board is just being removed to get at something else, leave the AC power cord receptacle installed.

6. Remove the three screws (Figure 9, #1) that secure the main logic board to the metal chassis. Note which screw holds the ground wire.

7. Fold back the rubber boot enclosing the anode cap until the metal anode clip is exposed; then use the pliers to squeeze the prongs on the anode clip together while you remove the clip from the CRT.

8. Slide the main logic board out of the metal chassis about four inches.

9. Carefully unplug connector DY (Figure 9, #3).

10. Remove the main logic board from its metal tray.

11. Remove the three adjustment knobs on the back of the logic board that match the monitor case. Save the knobs to use on the replacement board.

Replace

1. Set the monitor upright on its feet.

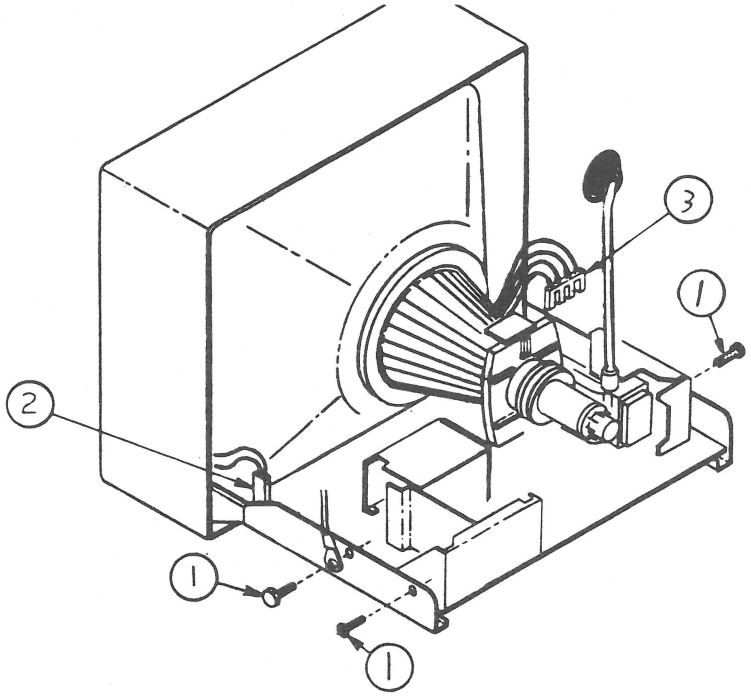

FIGURE 10

2. Slide the main logic board about an inch into its metal tray, and install connector DY (Figure 10, #3).

   Note: The logic board must slide between the notches in the sides of the metal tray. If the board is not installed between these notches, it can short out to the metal tray.

3. Slide the main logic board the rest of the way into its metal tray. Replace the three screws (Figure 10, #1) and the ground wire.

4. Replace the AC cord assembly if it was removed.

5. Use the pliers to squeeze the prongs on the anode clip together while you install it into the anode on the CRT.

6. Install the PC connector (from the degaussing coil surrounding the CRT—Figure 10, #2) on the main logic board.

7. Plug connectors SA and LE into the CRT Video board, and replace the CRT video board if it was removed.

8. Replace the three plastic knobs that match the case.

9. Replace the rear cover.

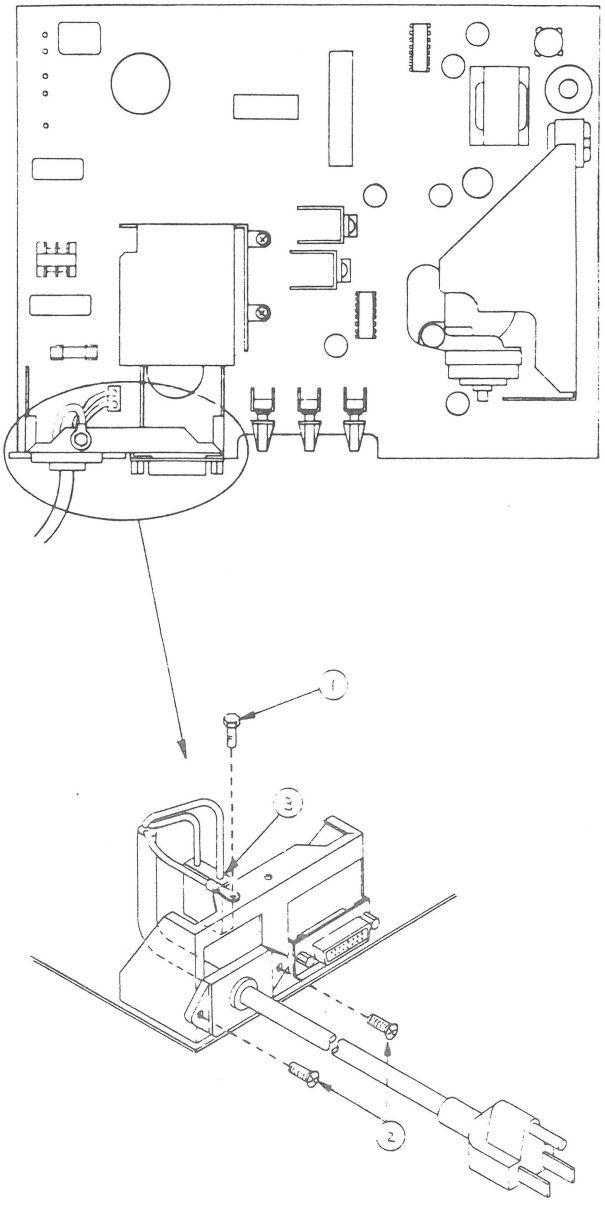

FIGURE 11

❑ AC CORD ASSEMBLY

Materials Required

Medium Phillips screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT if it hasn't already been discharged.
3. Unscrew the two screws securing the AC cord to its metal bracket (Figure 11, #2).
4. Remove the bolt and lockwasher that secure the power cable's green ground wire to the metal chassis (Figure 11, #1) Remove the yellow and green wire next to it as well.
5. Disconnect the AC connector from the main logic board (Figure 11, #3).

Replace

1. Install the two screws that mount the AC cord receptacle to its metal bracket (Figure 11, #2).
2. Install the bolt and lockwasher that secure the power cable's green ground wire to the metal chassis (Figure 11, #1).
3. Connect the connector labelled "AC" to the main logic board (Figure 11, #3).
4. Replace the rear cover.

❑ CATHODE-RAY TUBE (CRT)

CAUTION: *Liquids may damage the funnel's conductive coating. Do not use any liquid cleaner (even water) on the funnel (the portion of the CRT inside the case). Wipe the funnel with a clean dry cloth.*

Materials Required

40-watt soldering iron, solder, and solder sucker
Medium Phillips screwdriver
Sharp diagonal cutters
RTV or silicon glue
Small cable ties

Remove

1. Remove the rear cover.
2. Discharge the CRT.
3. Remove the main logic board.
4. Place the monitor face down on a protective pad (Figure 12).

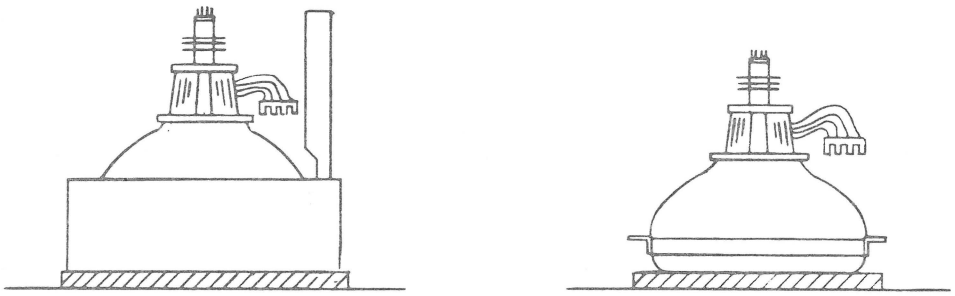

FIGURE 12

5. Locate the degaussing coil (Figure 13, #1). It is braced to the CRT by two plastic holding tabs (Figure 13, #2). Pull the tab strips out of the tab cutouts and bend the strips out to free the degaussing coil. Carefully lift out the coil.

6. Remove the four CRT mounting screws (Figure 13, #3) with the washers.

7. If the top metal CRT mounting bracket gets in the way, remove it.

8. Set the monitor on its base (foot). Firmly grasp the thick part of the base (not the yoke) as you tip the bezel, and carefully slide the CRT out from the front bezel.

9. Remove the silver mesh cable (Figure 13, #4) with the spring attached. Save this cable to use on the replacement CRT.

WARNING: *If you intend to dispose of the CRT, refer to "Disposing of the Cathode-Ray Tube" in Section 8, CRT Safety, under the* You Oughta Know *tab.*

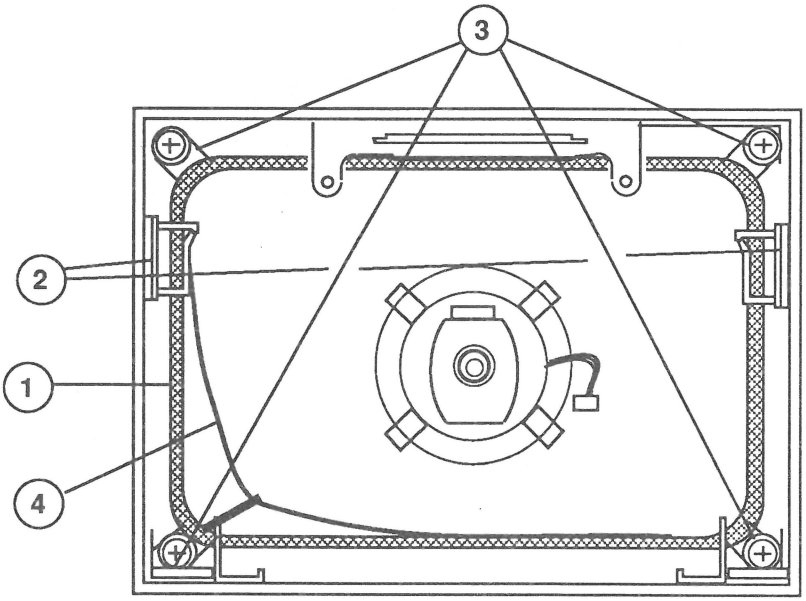

FIGURE 13

Replace

1. Place the front bezel face down on a clean, soft surface.

2. Replace the silver mesh cable (Figure 14, # 5) with the spring attached. Hook the spring to the lower left corner.

3. Replace the metal CRT mounting brackets (top and bottom). Make sure that the triangular plastic mounting piece is installed on the bottom metal bracket and that the LED cable goes out the lower left side of the bezel on the outside of the main logic board tray.

WARNING: *Do not touch the yoke (neck) of the CRT.*

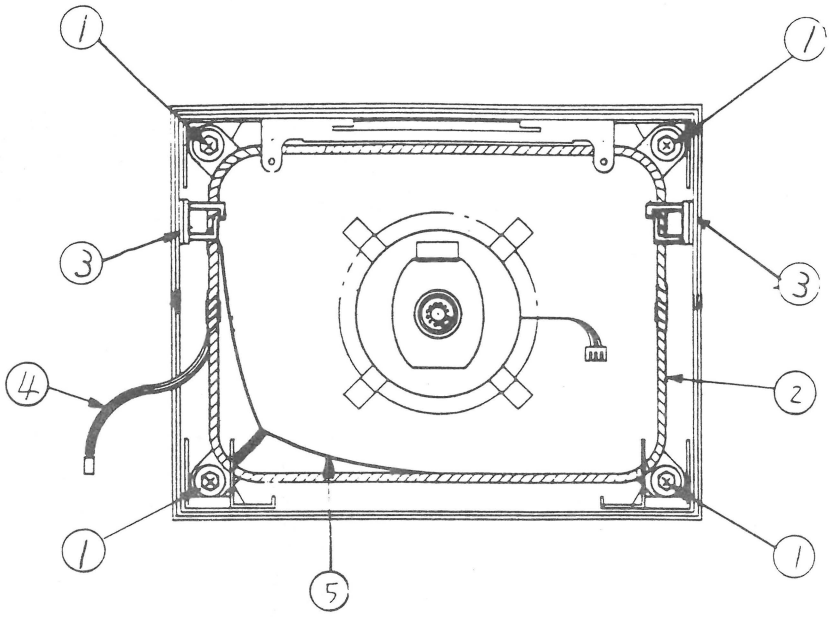

FIGURE 14

4. Carefully set the CRT inside the bezel. It may be necessary to flex the top of the bezel a little to fit the CRT inside of it.

5. Replace the four mounting screws and washers (Figure 14, #1).

6. Replace the degaussing coil (Figure 14, #2) over the CRT so that its connector (Figure 14, #4) is at your left when facing the monitor.

7. Bend the degaussing coil retaining tab strips back into the tab cutouts to secure the degaussing coil.

8. Replace the main logic board.

   Note: Make sure that the black CRT ground wire is positioned up toward the top of the bezel so that when the main logic board is installed the wire will clear the board.

9. Replace the CRT video board.

10. Replace the rear cover.

❑ LED ASSEMBLY

Materials Required

40-watt soldering iron, solder, and solder sucker
Medium Phillips screwdriver
Sharp diagonal cutters
RTV or silicon glue
Small cable ties
Small flatblade screwdriver

Remove

1. Remove the rear cover.
2. Discharge the CRT.
3. Remove the main logic board.
4. Disconnect the LED cable from connector LE on the CRT video board (Figure 15, #1). Cut any cable ties that prevent the cable from being removed from the CRT video board.

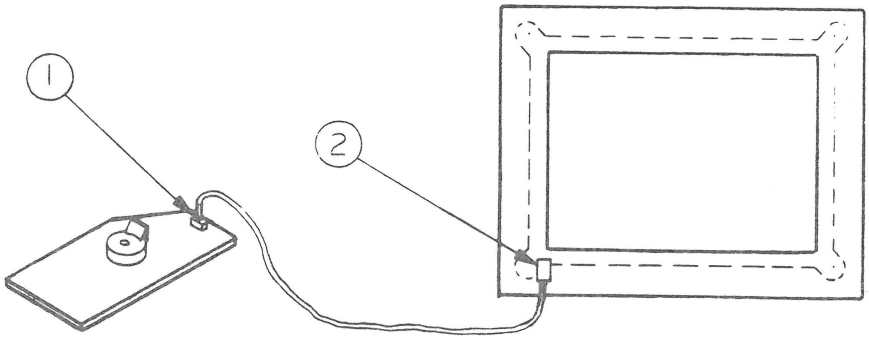

FIGURE 15

5. Remove the CRT.

6. Pull the LED free from the front bezel. If the LED is stuck, use the small flatblade screwdriver to loosen it from its plastic holder. Then bend the retaining arm on the holder very slightly while you pull out the LED.

Replace

1. Position the LED assembly in the plastic holder so that its wires point toward the nearest corner (Figure 15, #2).

2. Replace the CRT.

3. Replace the main logic board.

4. Replace the CRT video board.

5. Connect the LED cable to its connector on the CRT video board (Figure 15, #1).

6. Replace the rear cover.

❑ MAIN LOGIC BOARD FUSE

Materials Required

Medium Phillips screwdriver (6-inch shaft)
Fuse puller

Replacing Fuse 901

1. Remove the rear cover.
2. Discharge the CRT.
3. Locate fuse F901. It is mounted to the component side of the main logic board (Figure 16, #1).

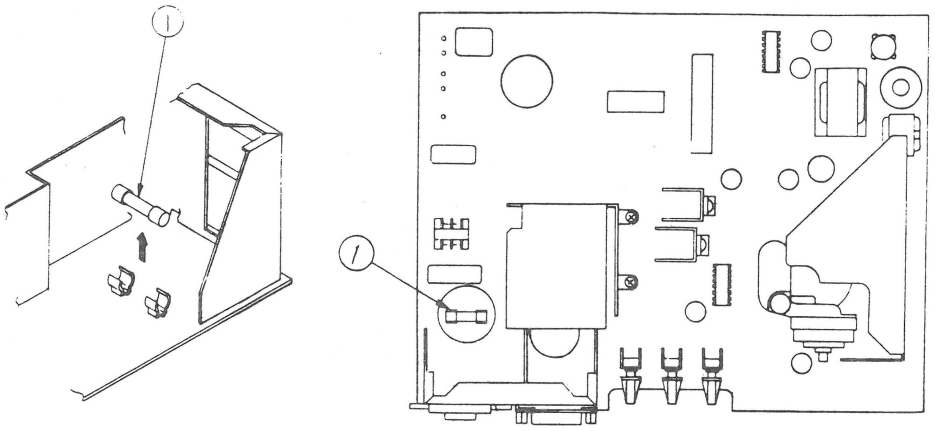

FIGURE 16

4. Check fuse F901. If it is blown, replace it with a new one.

CAUTION: *Do not try to slide the fuse sideways. You may break the fuse holder.*

5. Replace the rear cover.

Apple Technical Procedures

AppleColor RGB Monitor

Section 3 – Adjustments

❑ CONTENTS

3.3 Introduction
3.3 Important Safety Tips
3.4 Pre-Adjustment Set-Up Procedure
3.6 Vertical Adjustments
3.7 Horizontal Adjustments
3.9 Linearity Adjustments
3.9 Focus Adjustments
3.11 Color Adjustments

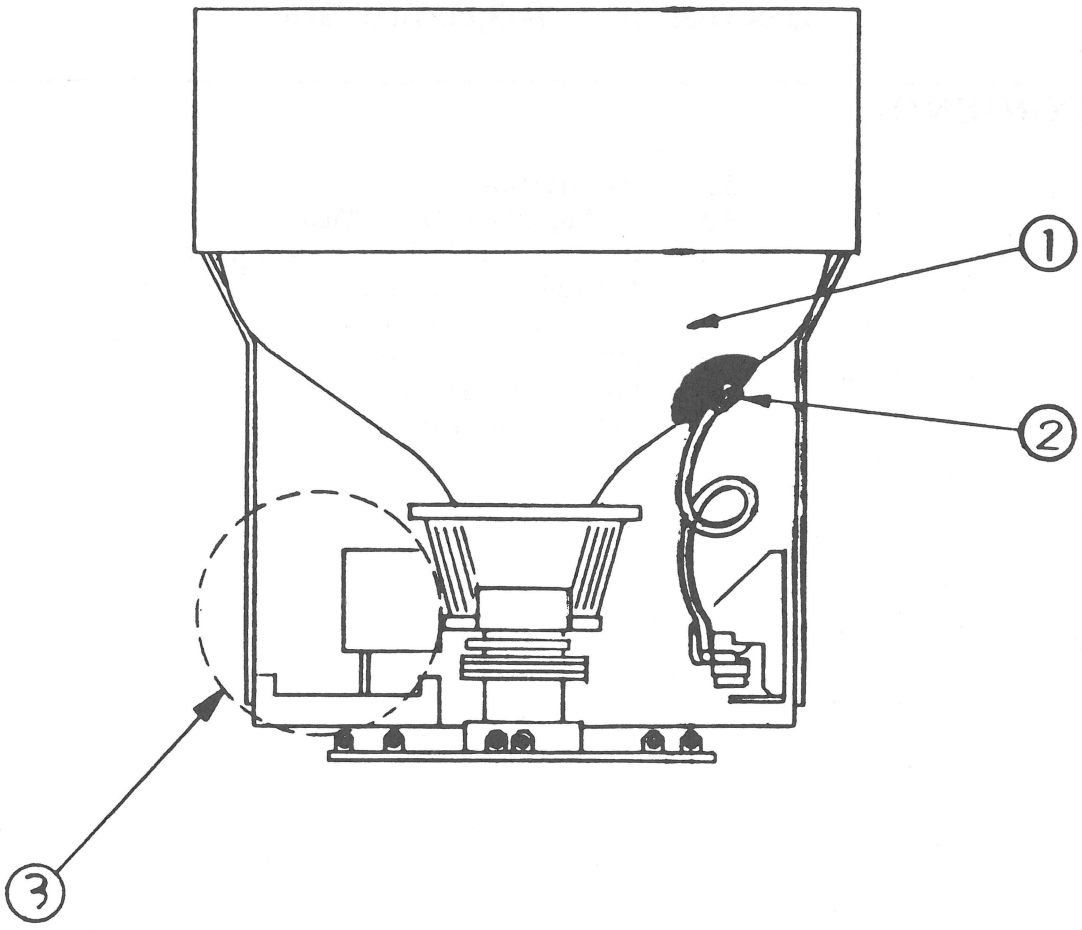

FIGURE 1

❑ INTRODUCTION

Check Adjustments First

If you are unsure which adjustments to perform, perform the Check Adjustments procedure in the "Troubleshooting" section first.

Adjust Color Only When Necessary

Do not change the internal color adjustments if the color quality is within acceptable range! Perfect color adjustments require special equipment. The color adjustments in this section will only allow you to achieve an acceptable level of color production in those rare cases where adjustment is necessary.

Do Not Adjust the Yoke

All yoke adjustments have been preset by the manufacturer. Do not attempt to make any tilt, ring, or geometric adjustments on the ColorMonitor. If the monitor cannot be corrected using the following procedures, use the Troubleshooting Table found in the "Troubleshooting" section to isolate the faulty module.

Important Safety Tips

***WARNING**: Read and follow the safety instructions below. Failure to follow them could result in electrical shock.*

Safety Instructions

1. During these adjustments your hand will come close to extremely high voltages on the tube, anode, anode lead, and in the power supply area (Figure 1, #1, #2, and #3). Avoid touching these parts.

2. Use only one hand to make all adjustments! Never touch the chassis while making adjustments.

3. Use only a three-prong grounded electrical outlet installed by a qualified electrician, and do not under any circumstances use an adapter plug.

4. Do not attempt to make any adjustments on the monitor other than those directed herein, and do those with extreme caution.

5. Read and follow the Safety Precautions in the Basics section for this product.

❑ PRE-ADJUSTMENT SET-UP PROCEDURE

Materials Required

AppleColor RGB Monitor
Apple IIGS™ computer with a disk drive connected
Apple® IIe, IIc, IIGS Diagnostic 1.0 (3.5) diskette or
Apple IIGS Diagnostic 1.0 (5.25) diskette
8 inch (or longer) plastic alignment tool (tweaker)
Mirror with prop (for viewing screen during adjustments)
12 inch ruler

Set-up

1. To see if an adjustment is necessary and to obtain the proper test pattern displays for each adjustment, perform the Adjustments Check in the Troubleshooting Section.

2. Turn the monitor off, disconnect the power cord and computer video cable and remove the rear cover. (See "Rear Cover" in the Take-Apart section.).

3. Remove the switch panel from the rear cover leaving the on/off switch and brightness and contrast controls installed on the panel. (See "Switch Panel Controls" in the Take-Apart section.)

4. Set the monitor on its feet and install connector S3 from the switch panel to the main logic board and connector VC from the switch panel to the CRT video board.

5. Reconnect the power cord and video cable and turn on the monitor and the computer.

6. After allowing the monitor to warm up for 15 minutes, select a test pattern display appropriate for the desired adjustment from the Apple IIGS Diagnostics Diskette. If unsure which test pattern is necessary or how to display it, refer to the Adjustments Check procedure in the Troubleshooting Section.

7. Prop the mirror in front of the monitor's screen so that you can see its display as you adjust.

8. Adjust the monitor's BRIGHTNESS control (Figure 2, #1) to its detent (click) position.

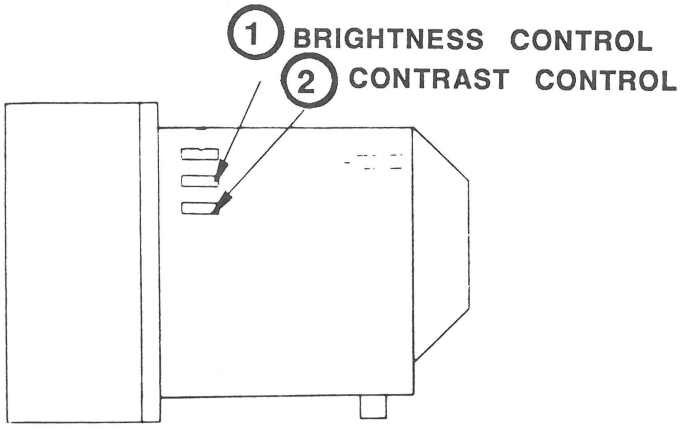

FIGURE 2

9. Adjust the monitor's CONTRAST control (Figure 2, #2) to its maximum clockwise position.

10. Perform the appropriate AppleColor RGB Monitor adjustment.

❑ VERTICAL ADJUSTMENTS

1. To see if an adjustment is necessary and to obtain the proper test pattern display for the vertical adjustment, perform the Adjustments Check in Section 4, Troubleshooting.

2. Perform the Pre-Adjustment Set-Up Procedure in this section.

3. Vertical Hold: If the image is rolling, adjust the vertical hold control VR401 (Figure 3, #2) until the picture is locked.

   Switch the monitor off and back on, to make sure the vertical hold is secure.

4. Vertical Height: If the vertical height of the image is incorrect, adjust V-HEIGHT VR403 (Figure 3, #3) until the height of the active portion of the display is 5 9/10 inches.

5. Vertical Center: If the vertical position of the entire image is off, adjust VPOS1 and VPOS2 (Figure 3, #4) until the image is centered.

6. Replace the rear cover. (See "Rear Cover" in the Take-Apart section.)

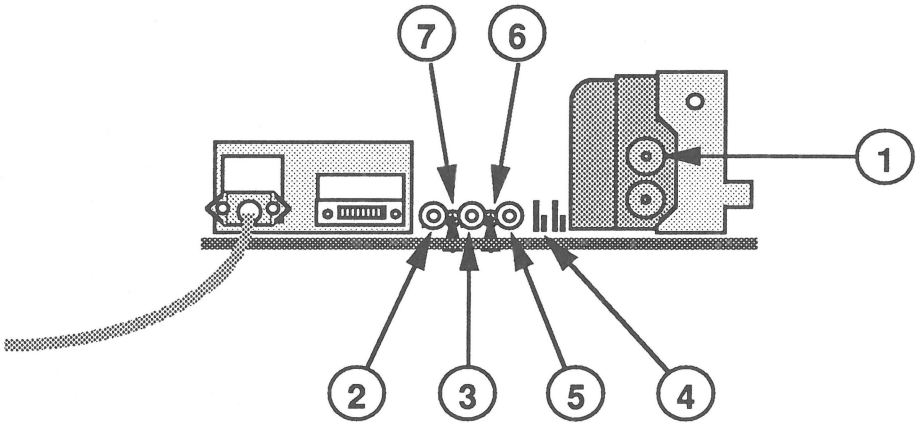

FIGURE 3

❑ HORIZONTAL ADJUSTMENTS

1. To see if an adjustment is necessary and to obtain the proper test pattern display for the horizontal adjustment, perform the Adjustments Check in Section 4, Troubleshooting.

2. Perform the Pre-Adjustment Set-Up Procedure in this section.

CAUTION: *Misadjustment of the H-HOLD control (adjusting the control too high or too low) could damage sensitive electronic components in the AppleColor RGB Monitor. To protect these components, the monitor automatically shuts down when the H-HOLD control (VR502) is adjusted too high or too low.*

3. Horizontal Hold: If the picture is tearing (not locked), adjust H-HOLD VR502 (Figure 3, #5). **Keep in mind that VR502 is a fine adjustment control and adjusting this variable resistor too high or too low may cause the monitor to shut down.** If this happens, switch off the monitor and turn the H-HOLD control to the center of its limits. Wait 30 seconds, and then switch on the monitor and resume the adjustment.

   After completing the horizontal hold adjustment, switch the monitor off and then back on. Make sure the horizontal hold is secure.

...Continued on next page

4. Horizontal Width: Measure the width of the active portion of the display. Adjust H-WIDTH L552 (Figure 4, #2) for about 7 7/8 inches.

***WARNING**: Avoid contact with the anode on the CRT (Figure 4, #1) during this adjustment or personal injury due to electrical shock could result.*

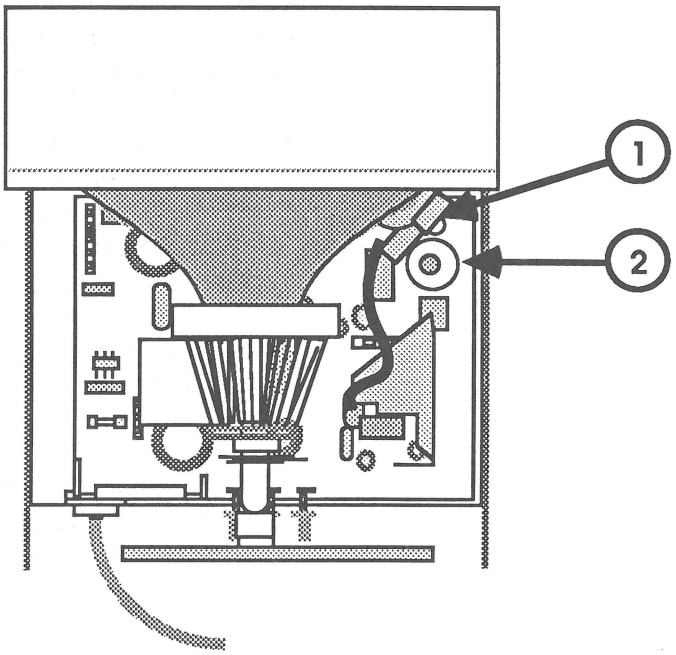

FIGURE 4

5. Horizontal Center: If the image is too far to one side of the screen, adjust H-CENTER VR501 (Figure 3, #6) until the image is centered.

6. Replace the rear cover. (See "Rear Cover" in the Take-Apart section.)

❑ LINEARITY ADJUSTMENTS

1. To see if adjustment is necessary and to obtain the proper test pattern display for this adjustment, perform the Adjustments Check in the Troubleshooting Section.

2. Perform the Pre-Adjustment Set-Up Procedure in this section.

3. VERTICAL HEIGHT: Measure the height of the active portion of the display. Adjust V-HEIGHT VR 403 (Figure 3, #3) for about 5 9/10 inches.

4. Adjust V-LIN VR 402 (Figure 3, #7) so that all the boxes in the display are close to the same size.

5. Replace the rear cover. (See "Rear Cover" in the Take-Apart section.)

❑ FOCUS ADJUSTMENTS

1. To see if an adjustment is necessary and to obtain the proper test pattern display for this adjustment, perform the Adjustments Check in the Troubleshooting Section.

2. Perform the Pre-Adjustment Set-Up Procedure in this section.

3. Locate the focus adjustment on the flyback transformer on the main logic board (Figure 3, #1).

4. Adjust the FOCUS control for optimum focus in the 80 column text display.

5. Turn off the monitor and the computer and disconnect the video cable and power cords.

6. Replace the rear cover. (See "Rear Cover" in the Take-Apart section.)

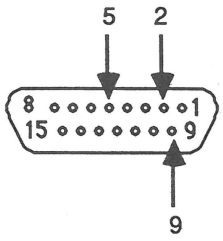

FIGURE 5

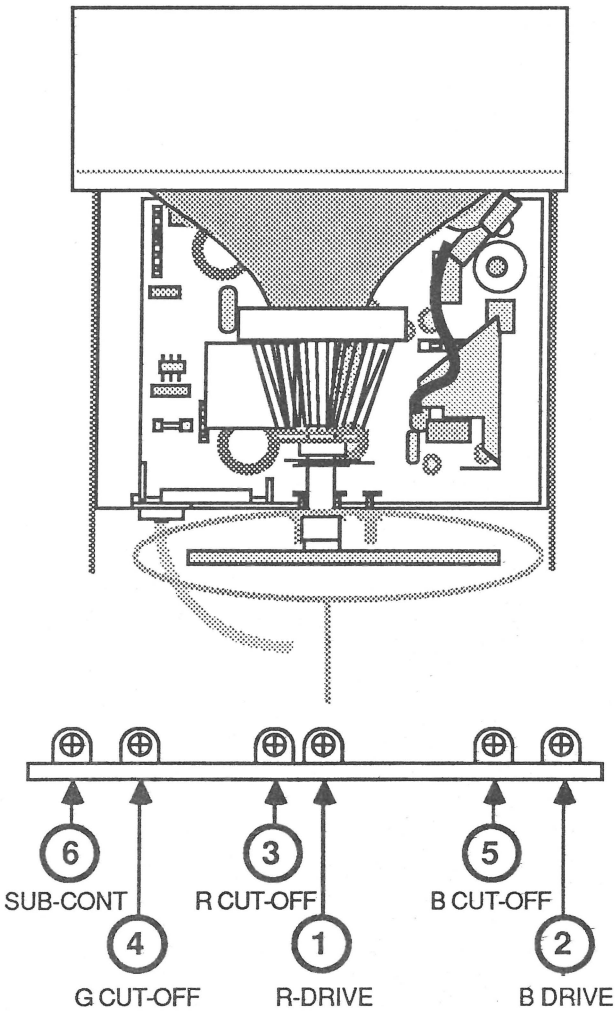

FIGURE 6

❑ COLOR ADJUSTMENTS

Materials Required

Apple-supplied light meter (Sekonic MultiLumi, L248)
A modified AppleColor RGB Monitor cable
with pins 2, 5, and 9 cut or removed (Figure 5). (These pins carry external RGB video signals from the computer to the monitor. Cutting them prevents the external video from interfering with the static internal color adjustments described below.)

Adjustment Procedure

1. To see if an adjustment is necessary, perform the Adjustments Check in Section 4, Troubleshooting. (For the check, make sure a standard [unmodified] cable is installed.)

2. Perform the Pre-Adjustment Set-Up Procedure in this section.

WARNING: *The main logic board has extremely high voltages. Use the insulated tool in one hand only, and watch what you are touching!*

3. Turn the monitor and the computer off and install the modified cable (see Materials Required, above).

4. With the monitor off, set the controls as directed below, using the plastic alignment tool or insulated screwdriver.

   - Set the following controls at full counterclockwise:

     R-CUT-OFF (red) - Figure 6, #3 (bias control)
     G-CUT-OFF (green) - Figure 6, #4 (bias control)
     B-CUT-OFF (blue) - Figure 6, #5 (bias control)

   - Set the following controls 30 degrees clockwise past the centers of their ranges:

     R-DRIVE (red) - Figure 6, #1
     B-DRIVE (blue) - Figure 6, #2

     Note: There is no drive adjustment for green.

   - Set the following control to the center of its range:

     SUB-CONT (subcontrast) - Figure 6, #6

5. Turn on the computer and the monitor and let the monitor warm up for 15 minutes.

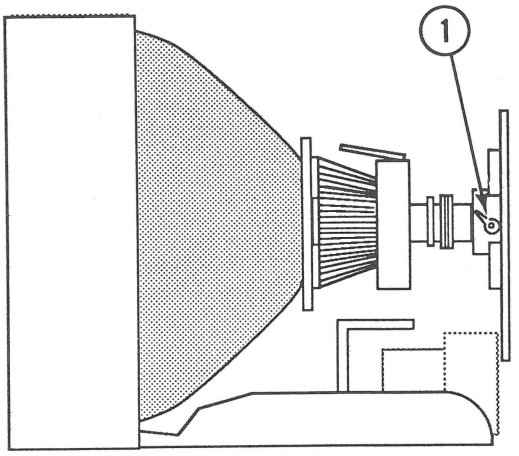

FIGURE 7

6. Position the SERVICE switch lever up (Figure 7, #1).

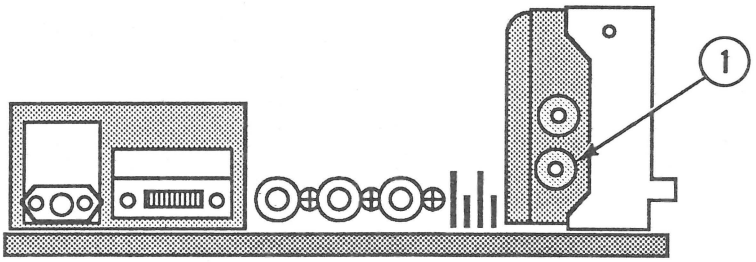

FIGURE 8

7. Turn the SCREEN control (Figure 8, #1) fully counterclockwise, then turn it back until a dim horizontal line just appears on the monitor display.

8. Adjust one or more of the CUT-OFF controls until the horizontal line is a low-intensity white (no predominant color). The controls are:

   - R-CUT-OFF (red) - Figure 9, #1
   - G-CUT-OFF (green) - Figure 9, #2
   - B-CUT-OFF (blue) - Figure 9, #3

9. Set the SERVICE switch (Figure 7, #1) back to its normal position (down).

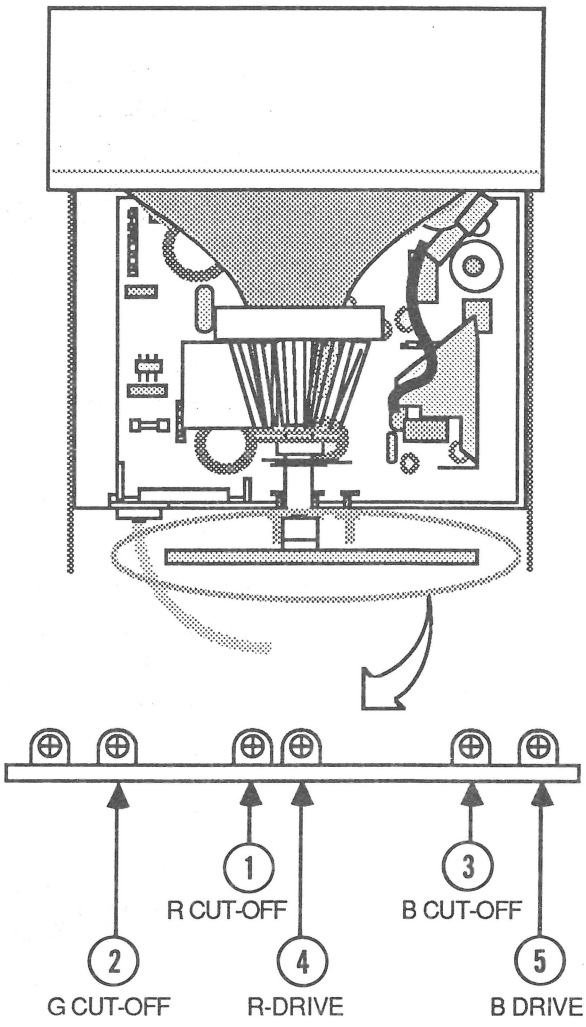

FIGURE 9

10. Turn off the monitor and the computer. Remove the modified video cable and replace it with the standard video cable. Turn on the monitor and the computer.

11. Using the diagnostic diskette, select the border test pattern that produces a white screen (see the Adjustments Check procedure, "To Select a Test," in Section 4, Troubleshooting).

12. Adjust either or both DRIVE controls (Figure 9, #4 and #5) until the screen is a neutral gray. (If you cannot get the screen color balanced to gray, go back to step 3 and repeat the procedure again, making sure that the low-intensity line of step 8 is really a neutral white.)

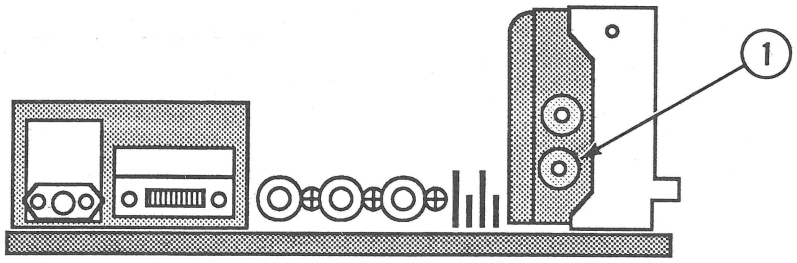

FIGURE 10

13. Set the CONTRAST and BRIGHTNESS controls on the switch panel to minimum.

14. If the screen is still visible, turn the SCREEN control (Figure 10, #1) counterclockwise until the display disappears.

15. Set the CONTRAST control on the switch panel to maximum and the BRIGHTNESS control to its center click (detent) setting.

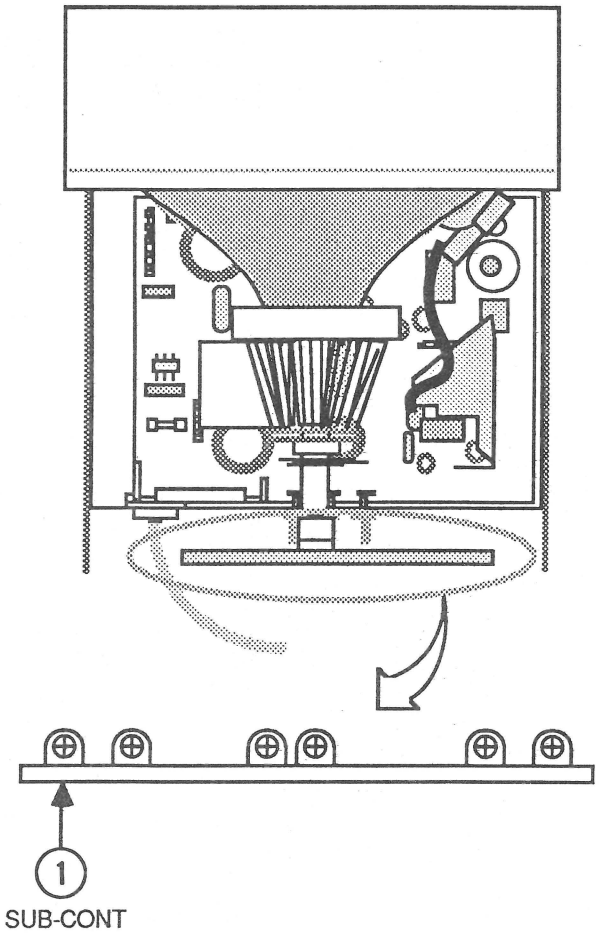

FIGURE 11

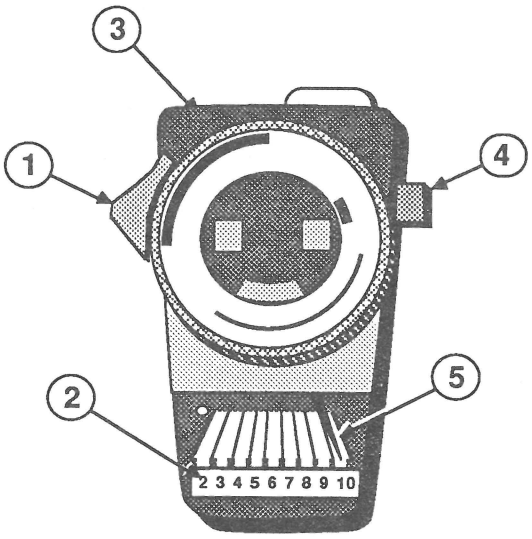

FIGURE 12

16. Use the light meter (Figure 12) to measure the luminance at the center of the screen, as follows:

    a) First, to ensure that the light meter is working correctly, press the red button on the back of the unit. If the reading is out of the red area, replace the battery and test again. If the reading is still out of the red area, replace the meter.

    b) Move the side switch (Figure 12, #1) to its lower position so that the lower scale (Figure 12, #2) reads 2 through 10.

    c) Uncover the lens of the meter (Figure 12, #3). Place the lens against the exact center of the screen and press the "read" button (Figure 12, #4).

    The lower scale reading should be precisely in the middle of "10" (Figure 12, #5). If it is not, adjust the SUB-CONT control (Figure 11, #1) until the luminance measures precisely in the middle of "10."

    If you are unable to achieve correct luminance by adjusting the SUB-CONT control, repeat the procedure from step 13. In step 14, the SCREEN control should be set so that the screen **just** disappears (but **completely** disappears).

13. Perform the Adjustments Check in Section 4, Troubleshooting, to see if the adjustments are correct.

14. Turn off the monitor and the computer, and disconnect the video cable and power cords.

15. Replace the rear cover. (See "Rear Cover" in Section 2, Take-Apart.)

Apple Technical Procedures

AppleColor RGB Monitor

Section 4 – Troubleshooting

❑ CONTENTS

4.2 Introduction
4.2 Important Terms
4.2 Directions
4.3 Adjustments Check Procedure
4.3 Set-Up
4.4 To Select a Test
4.4 To Deselect a Test
4.4 Perform Adjustment Checks
4.5 Geometric Display Checks
4.6 Focus Check
4.6 Color Check
4.7 Troubleshooting Table

❑ INTRODUCTION

This troubleshooting section consists of a symptom chart showing each symptom and a list of fixes.

Important Terms

There are two parts to the display on a monitor:

Video
Video is the information (characters, graphics, etc.) on the display. The video is usually displayed over the raster (described below) so that the raster is not visible.

Raster
The raster is the lit portion of the screen. When the raster is displayed by itself with no video, it looks like a blank white box.

Directions

First, go through the Adjustments Check in this section and refer to the Adjustments section to perform any necessary adjustments.

If adjustments didn't fix the problem, go to the Troubleshooting Table beginning on the page following the Adjustments Check and find the symptom which most closely resembles that exhibited by the defective monitor. Then try the recommended action(s) in the order listed.

If the problem still exists after trying the actions listed in the Troubleshooting Table, contact your Regional Technical Support Center for assistance.

❑ ADJUSTMENTS CHECK PROCEDURE

Materials Required

AppleColor RGB Monitor
Apple IIGS computer with disk drive connected
Apple IIe, IIc, IIGS Diagnostic 1.0 (3.5) diskette or Apple IIGS Diagnostic 1.0 (5.25) diskette

Set-Up

1. Allow the monitor to warm up for at least 15 minutes.

2. Adjust the BRIGHTNESS control (Figure 1, #1) to its detent (click) position.

3. Adjust the CONTRAST control (Figure 1, #2) to its maximum clockwise position.

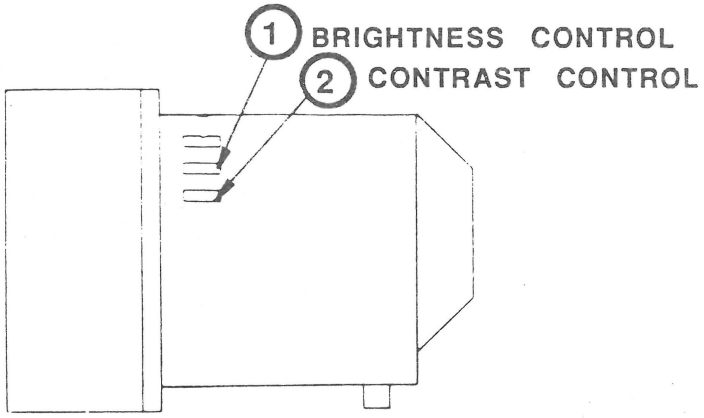

FIGURE 1

4. Install the Apple IIGS Diagnostics Diskette into the computer's drive and start up the program.

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To Select a Test

1. Select **Choose Tests** from the main menu and press <Return>.
2. Select **Video Pattern Tests** from the **Choose Tests** menu and press <Return>.
3. Select the desired test from the **Video Pattern Tests** menu and press <Return>. The number "1" should appear beside the test.
4. Press the <Escape> key **twice** to return to the main menu.
5. Select **Execute Selected Tests** from the main menu and press <Return>. The desired test pattern screen should now display on the monitor.

To Deselect a Test

1. Press <Escape> **twice** to return to the main menu.
2. Select **Choose Tests** from the main menu and press <Return>.
3. Select **Video Pattern Tests** from the **Choose Tests** menu and press <Return>.
4. Select the previously selected test from the **Video Pattern** Tests menu and press <Delete>. The number "1" should disappear.
5. Press <Escape> **twice** to return to the main menu.

Perform the Adjustment Checks

Perform the checks on the following pages. If a check indicates a need for an adjustment, refer to the Adjustments section for the adjustment procedure.

Geometric Display Checks

1. Select the "Super HiRes" test pattern display. (Refer to To "Select a Test" in this procedure if instructions are necessary.)

   Note: The screen should now display a series of "horizontal and vertical lines crossing each other to form boxes.

2. Use the guidelines below to determine what adjustment to make.

Vertical Check

a) Refer to "Vertical Adjustments" in the Adjustments section if:

- the grid boxes in the top and bottom rows do not have about the same height.
- the square grid boxes are stretched out or compressed vertically.
- the picture is rolling.
- the image is pushed to the top or bottom.

Horizontal Check

b) Refer to "Horizontal Adjustments" in the Adjustments section if:

- the width of the grid boxes on both sides of the screen is not about the same.
- the square grid boxes are stretched out or compressed horizontally.
- the picture is tearing (appears ripped).
- the picture is pushed more to one side of the screen than the other.
- the picture is rolling in a diagonal movement on the horizontal plane.

Linearity Check

c) Refer to the "Linearity Adjustment" in the Adjustments section if the grid boxes are not all the same size.

3. Deselect the "Super HiRes" test pattern display.

Focus Check

1. Select the "80 Col. Text" test pattern display. (Refer to "To Select a Test" in this procedure if instructions are necessary.)

   Note: The screen should now display horizontal rows of a characters and numbers.

2. Refer to the "Focus Adjustment" in the Adjustments section if the characters on the display screen are not focused correctly.

3. Deselect the "80 Col. Text" test pattern display.

Color Check

1. Select the "Color Bars" test pattern display. (Refer to "To Select a Test" in this procedure if instructions are necessary.)

   Note: The screen should now display vertical color bars.

2. Refer to "Color Adjustments" in the Adjustments section if the color is not correct.

3. Deselect the "Color Bars" test pattern display.

❑ TROUBLESHOOTING TABLE

Symptom	Action
• *Power switch on, LED off, raster not displayed*	1. Make sure that the power cord is plugged into a live power outlet. 2. Replace the main logic/power supply board. 3. Replace the CRT video board. 4. Replace the AC power cord assembly. 5. Replace the ON/OFF Switch.
• *Power switch on, LED on, raster not displayed*	1. Make sure that the video cable connection is secure. 2. Adjust the external BRIGHTNESS control. 3. Adjust the CONTRAST control. 4. Check fuse F901 on the main logic/power supply board. Replace if blown. 5. Check that all connectors are secure on the main logic/power supply board and the CRT video board. 6. Replace the main logic/power supply board. 7. Replace the CRT video board.
• *Raster displayed LED off*	1. Replace the LED assembly. 2. Replace the CRT video board.
• *One horizontal line appears*	1. Check to make sure that the internal SERVICE switch (S691) is in normal position (down). 2. Check that the yoke wires have not come loose and that the yoke connector is securely seated. 3. Replace the main logic/power supply board. 4. Replace the CRT.
• *One vertical line appears*	1. Check that the yoke wires have not come loose and that the yoke connector is securely seated 2. Replace the main logic/power supply board. 3. Replace the CRT.
• *One side of the raster is a different height than the other*	– Replace the CRT.

Symptom	Action
• *Abnormal raster*	1. Check to make sure all connectors are installed correctly. 2. Replace the main logic/power supply board.
• *Horizontal linearity won't adjust*	– Replace the main logic/power supply board.
• *Monitor makes high-pitched noise*	– Replace the main logic/power supply board.
• *Raster is small and abnormally bright*	1. Check the yoke connector. 2. Replace the main logic/power supply board. 3. Replace the CRT video board 4. Replace the CRT.
• *No vertical synchronization*	1. Adjust the VERTICAL HOLD control on the back panel. 2. Replace the main logic/power supply board.
• *Raster won't center*	– Replace the main logic/power supply board.
• *Can't adjust color, contrast, brightness, etc.*	1. Replace the main logic/power supply board. 2. Replace the CRT video board.
• *Characters jitter*	1. Make sure all ground straps are secure. 2. Verify that adjacent computer equipment is properly grounded. 3. Replace the main logic/power supply board. 4. Replace the CRT video board.
• *Vertical linearity won't adjust*	– Replace the main logic/power supply board.
• *Black spot remains when unit is off. (burnt phosphor)*	– Replace the CRT.

Symptom	Action
• *Picture too dark or too bright*	1. Adjust the external BRIGHTNESS control. 2. Replace the main logic/power supply board. 3. Replace the CRT video board.
• *Out of focus*	1. Replace the main logic/power supply board. 2. Replace the CRT.
• *Raster is one predominant color*	1. Perform the color adjustment procedure. 2. Replace the CRT video board. 3. Replace the main logic/power supply board.
• *No color*	1. Make sure that the software is supposed to display in color. 2. Replace the CRT video board. 3. Replace the main logic/power supply board.
• *Monitor shuts down*	1. H-HOLD control is misadjusted (adjusted too high or too low). Switch off monitor, return control to center of limits, switch on monitor, and repeat adjustment. 2. Replace the main logic/power supply board.
• *Flashing or wavy screen*	– Gently crimp the metal connector tabs on the video connector.

Apple Technical Procedures

AppleColor RGB Monitor

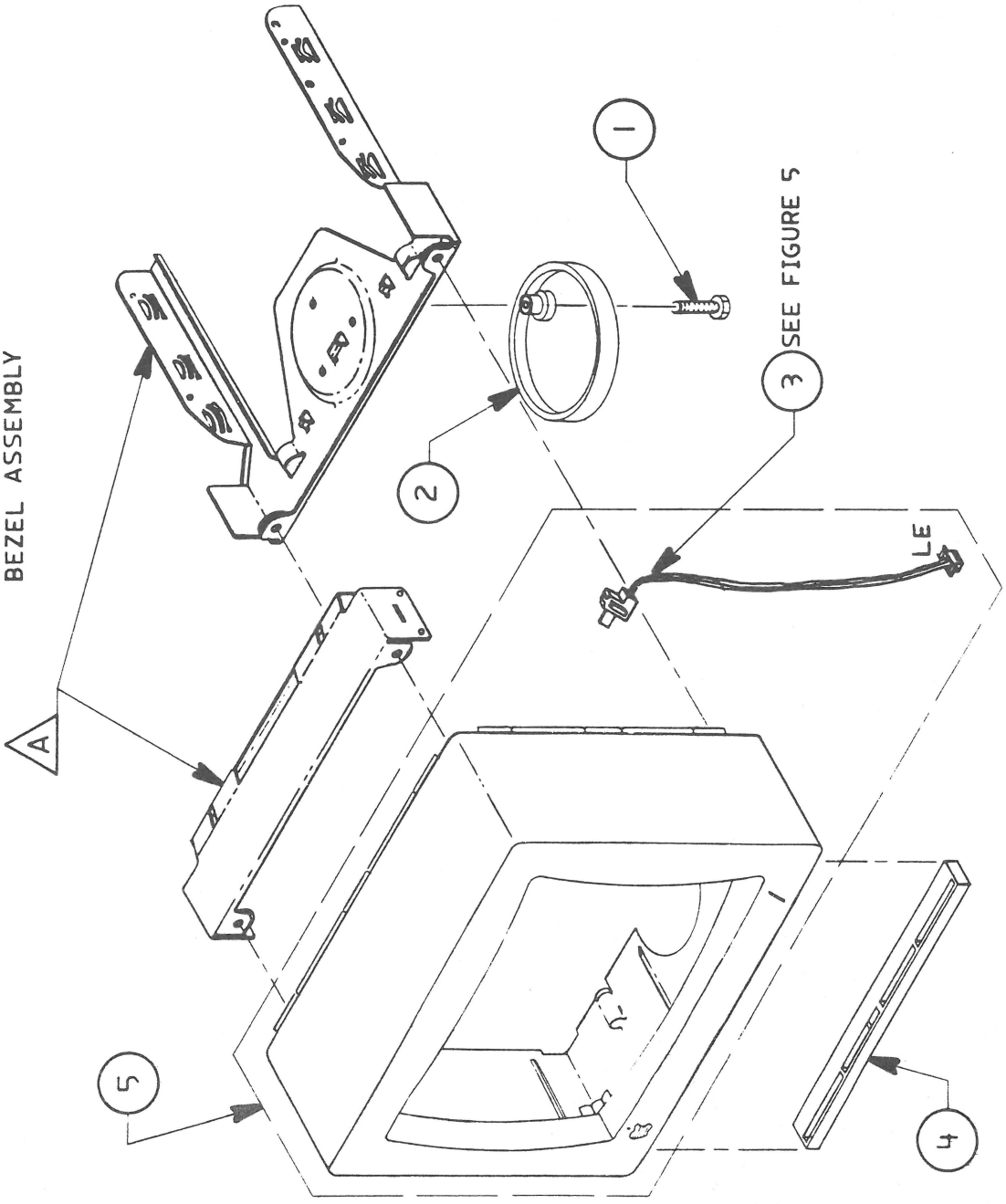
Section 5 – Illustrated Parts List

❑ CONTENTS

5.3 Bezel Assembly (Figure 1)
5.5 CRT (Figure 2)
5.7 Power Supply, Video Board (Figure 3)
5.9 Rear Cover and Controls (Figure 4)
5.11 Cables and AC Cord (Figure 5)

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the AppleColor RGB Monitor, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs Manual* for prices.

FIGURE 1
BEZEL ASSEMBLY



❑ RGB MONITOR – BEZEL ASSEMBLY (Figure 1)

Item	Part No.	Description
1	956-0003	Screw/Knob Set, AppleColor RGB (See also Figures 2, 3, and 4)
2	949-0057	Bottom Plate, Monitor
3	930-0004	LED Assembly, AppleColor RGB (See Figure 5.)
4	949-0056	Front Foot, Monitor
5	949-0054	Bezel Assembly, AppleColor RGB

Note: The items marked *A* are not available from Apple. If a new bezel is required, these parts must be retained from the old bezel and reinstalled in the replacement bezel.

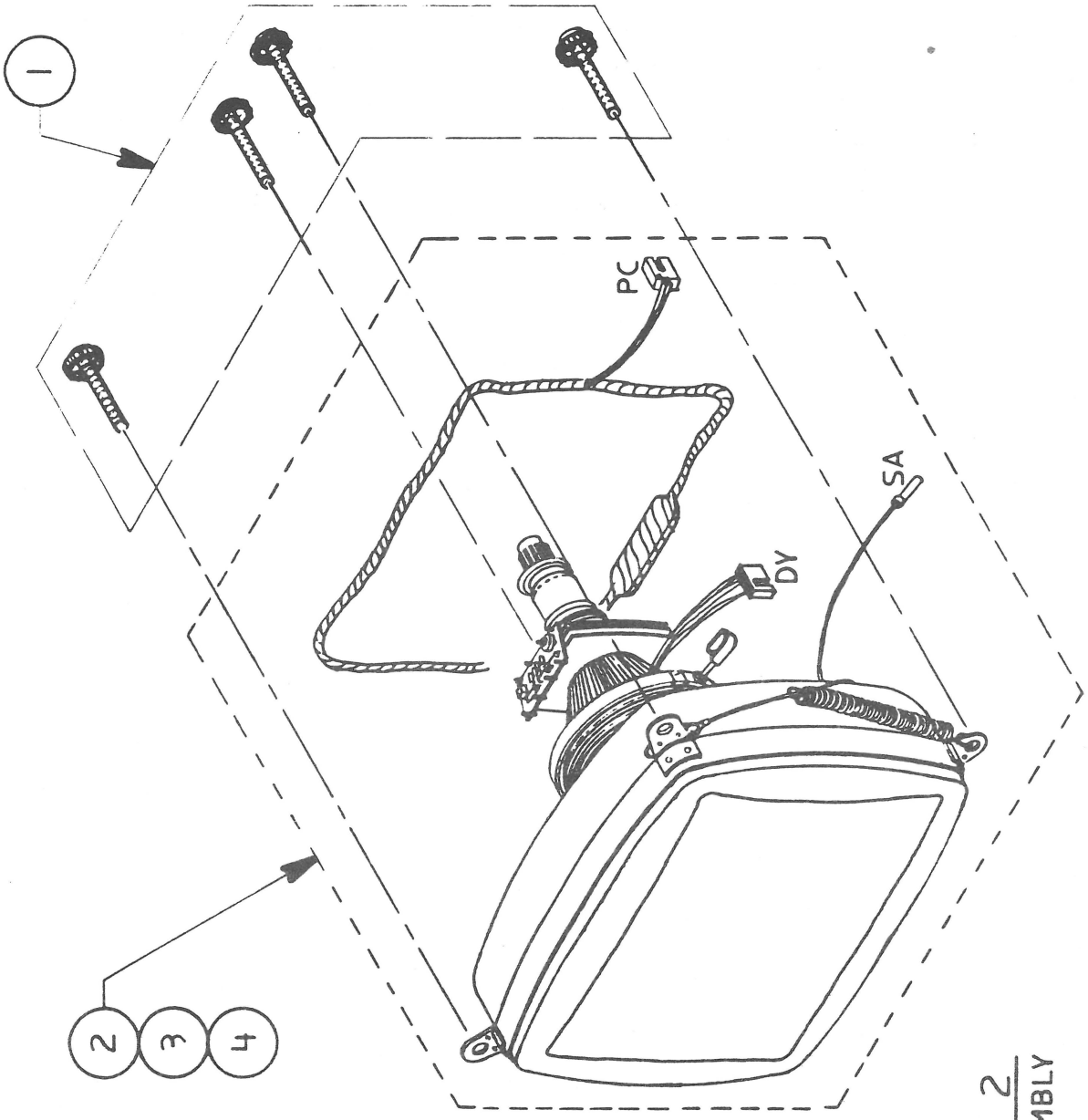


FIGURE 2
CRT ASSEMBLY

❑ RGB MONITOR – CRT (Figure 2)

Item	Part No.	Description
1	956-0003	Screw/Knob Set, AppleColor RGB (See also Figures 1, 3, and 4)
2	076-0207	CRT Assembly, AppleColor RGB, 110v
3	076-0232	CRT Assembly, AppleColor RGB, 220v
4	076-0233	CRT Assembly, AppleColor RGB, 240v

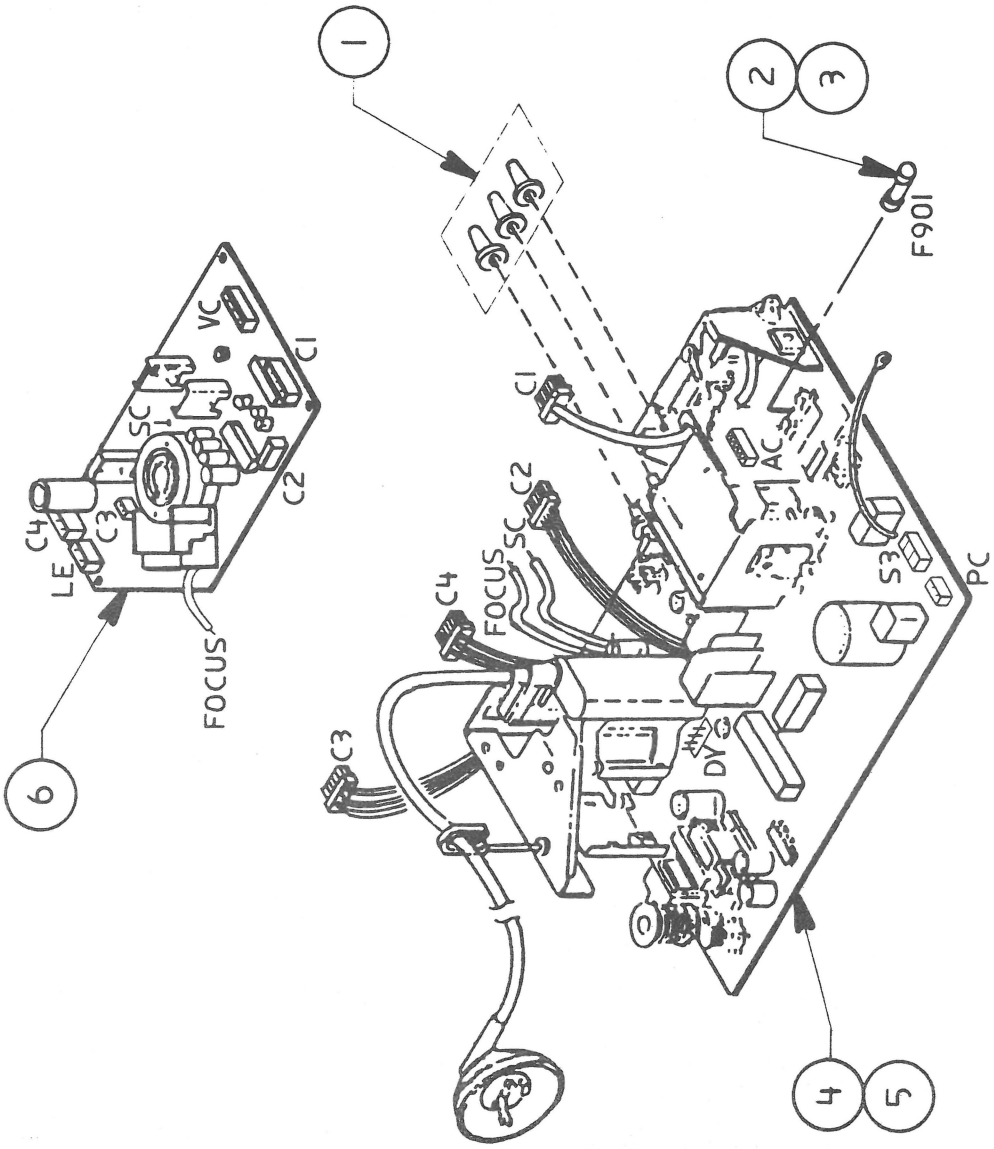


FIGURE 3
PCB'S

❑ RGB MONITOR – POWER SUPPLY, VIDEO BOARD (Figure 3)

Item	Part No.	Description
1	956-0003	Screw/Knob Set, AppleColor RGB (See also Figures 1, 2, and 4)
2	740-0309	Fuse, 3.15 Amp, 110v (F901)
3	740-0061	Fuse, 3.15 Amp, 250v (F901)
4	661-0348	AppleColor RGB Power Supply Board, 110v (Main Logic Board)
5	661-0358	AppleColor RGB Power Supply Board, 220/240v
6	661-0347	AppleColor CRT Video Board

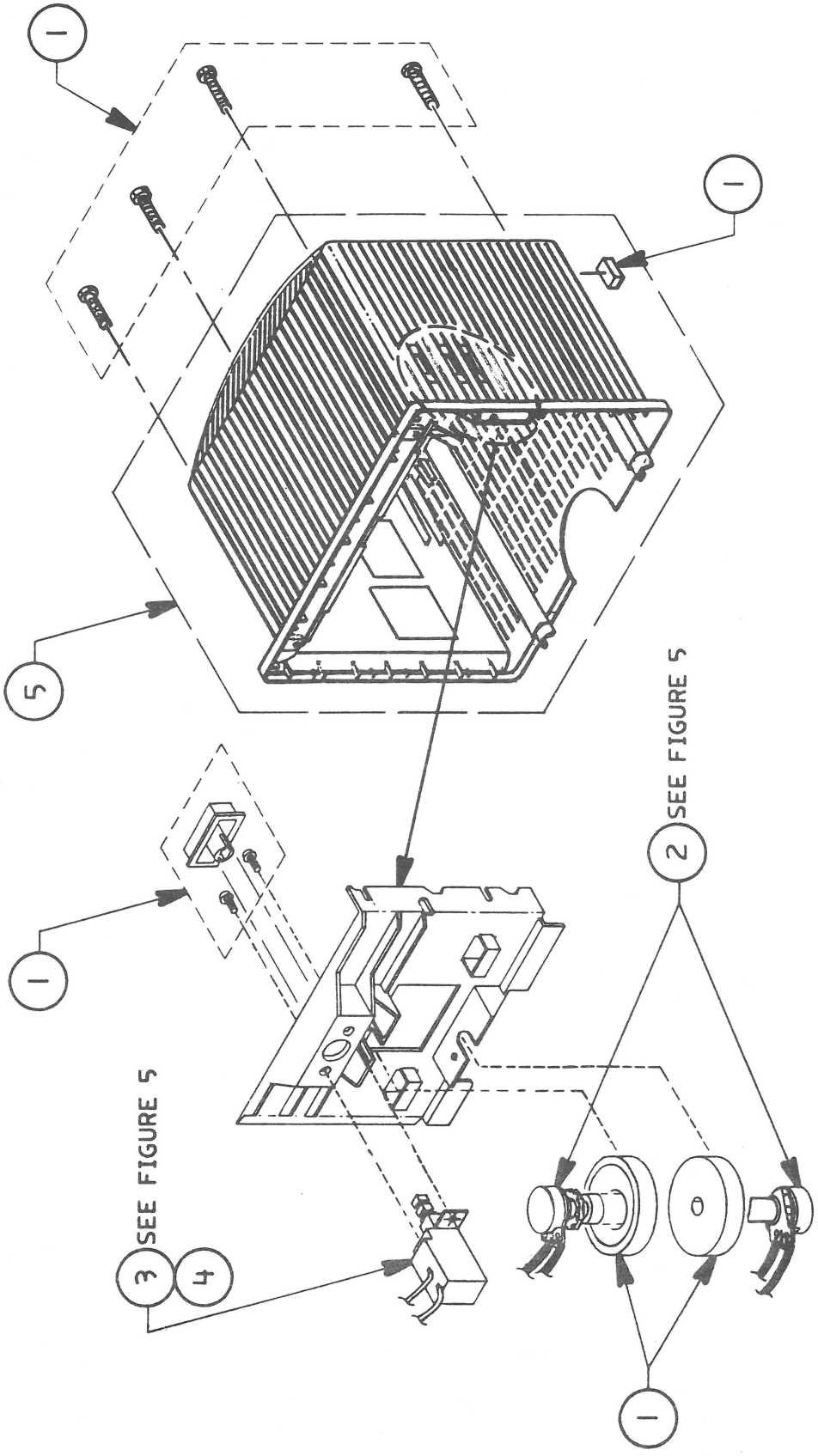


FIGURE 4
REAR COVER ASSEMBLY

❑ RGB MONITOR – REAR COVER AND CONTROLS (Figure 4)

Item	Part No.	Description
1	956-0003	Screw/Knob Set, AppleColor RGB (See also Figures 1, 2, and 3)
2	905-0001	Contrast/Brightness Control, AppleColor RGB
3	937-0014	On/Off Switch Assembly, AppleColor RGB, 110v
4	937-0015	On/Off Switch Assembly, AppleColor RGB, 220/240v
5	949-0055	Rear Cover, AppleColor RGB

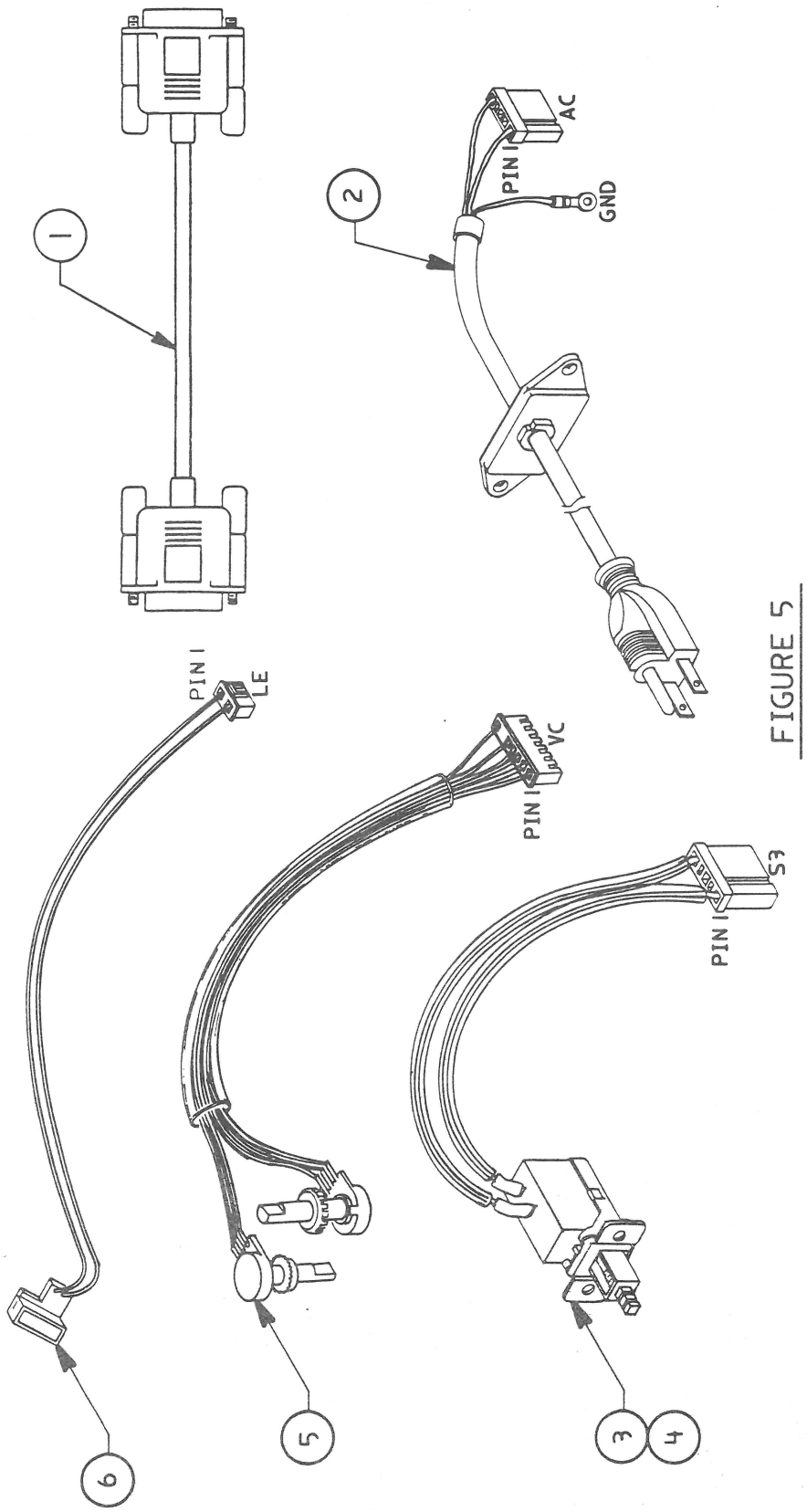


FIGURE 5

❑ RGB MONITOR—CABLES AND AC CORD (Figure 5)

Item	Part No.	Description
1	590-0536	RGB Video Cable, CPU to Monitor
2	935-0002	AC Cord, AppleColor RGB, 110 V
3	937-0014	On/Off Switch Assembly, AppleColor RGB, 110 V
4	937-0015	On/Off Switch Assembly, AppleColor RGB, 220/240 V
5	905-0001	Contrast/Brightness Control, AppleColor RGB
6	930-0004	LED Assembly, AppleColor RGB

Apple Technical Procedures

Monochrome Monitor

Technical Procedures

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5.3 Rear Cover Assembly (Figure 1)
5.5 CRT, Main Logic Board, and Transformer (Figure 2)
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5.9 Other Parts (Figure 4)

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Apple Technical Procedures

Monochrome Monitor

Section 1 – Basics

❑ CONTENTS

1.2 Product Description

❑ PRODUCT DESCRIPTION

The Apple® Monochrome Monitor is a 12-inch CRT display monitor that is used with the Apple II family of computers. The power switch and the contrast control for the Monochrome Monitor are shown in Figure 1, #1. The LED on the front case shows that the power is on.

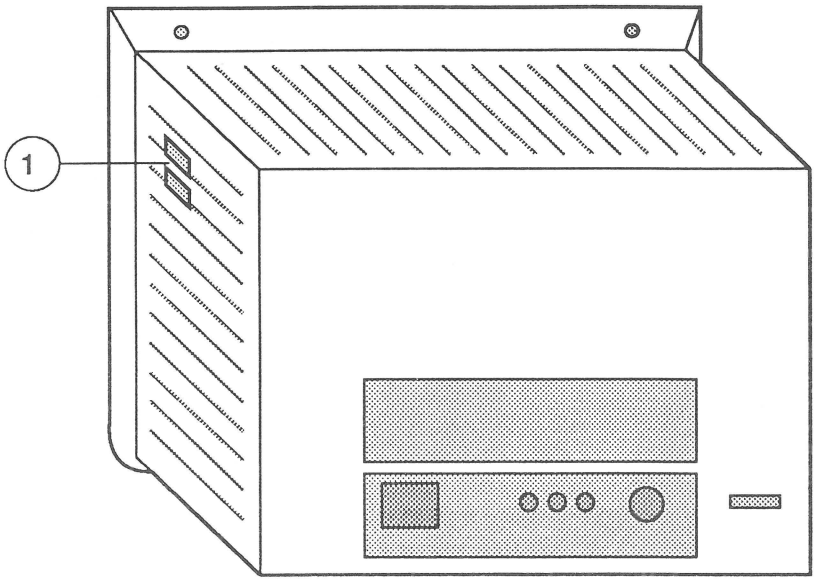

FIGURE 1

Figure 2 shows the international symbols that identify the other controls and sockets on the back.

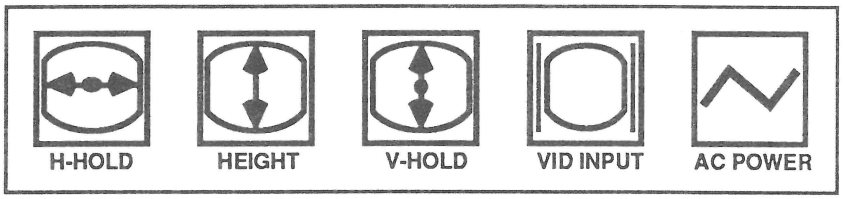

FIGURE 2

The Apple Monochrome Monitor contains a cathode-ray tube (CRT), which operates at very high voltages and contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself), scattering glass in all directions.

WARNING: Before working inside this monitor, read Section 8, CRT Safety, under the* You Oughta Know *tab.

Apple Technical Procedures

Monochrome Monitor

Section 2 – Take-Apart

❑ CONTENTS

2.2 Rear Cover
2.4 Discharging the Cathode-Ray Tube (CRT)
2.4 Discharge Procedure
2.6 Anode Cap
2.7 Main Logic Board, Switch Case, and AC Cord
2.15 Transformer
2.17 Cathode-Ray Tube (CRT)
2.19 Fuse
2.20 Power Switch
2.21 Contrast Control
2.23 LED Assembly
2.24 Bezel

Note: If a step is underlined, detailed instructions for that step can be found elsewhere in this section.

❑ REAR COVER

WARNING: *The Monochrome Monitor contains high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, be sure you read and understand the safety precautions in Section 8, CRT Safety, under the* You Oughta Know *tab before you remove the back cover.* ***Failure to follow the safety rules could result in serious injury.***

Materials Required

Medium Phillips screwdriver

Remove

1. Turn off the monitor and disconnect the AC cord and video cable from the monitor.
2. Place the monitor on its face on a soft surface to avoid damage to the CRT screen.
3. Pull the front foot off the plastic tabs under the bezel.
4. Remove the four Phillips screws (Figure 1, #1).

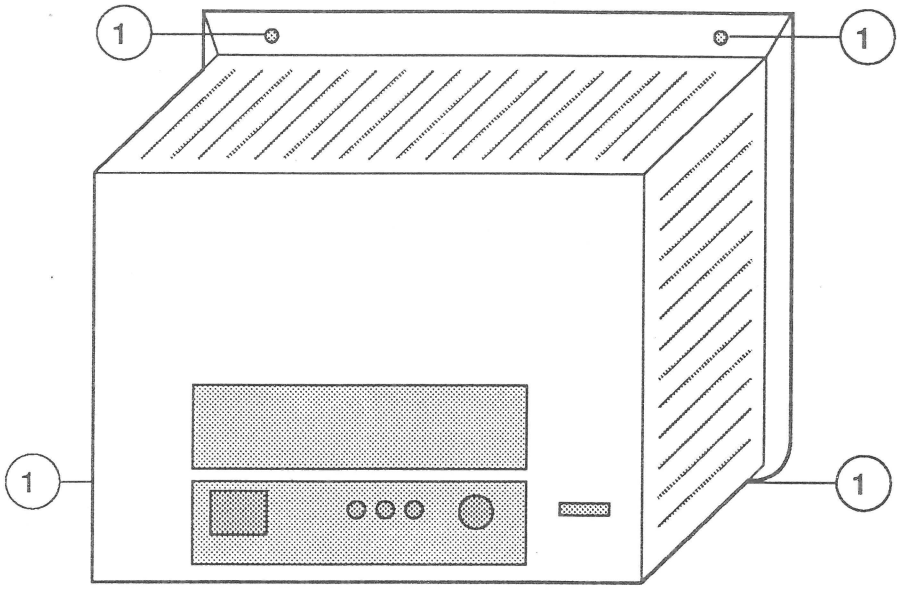

FIGURE 1

5. Set the monitor back on its feet, and turn it so that the on-off and brightness switches (Figure 2, #1) are toward you.

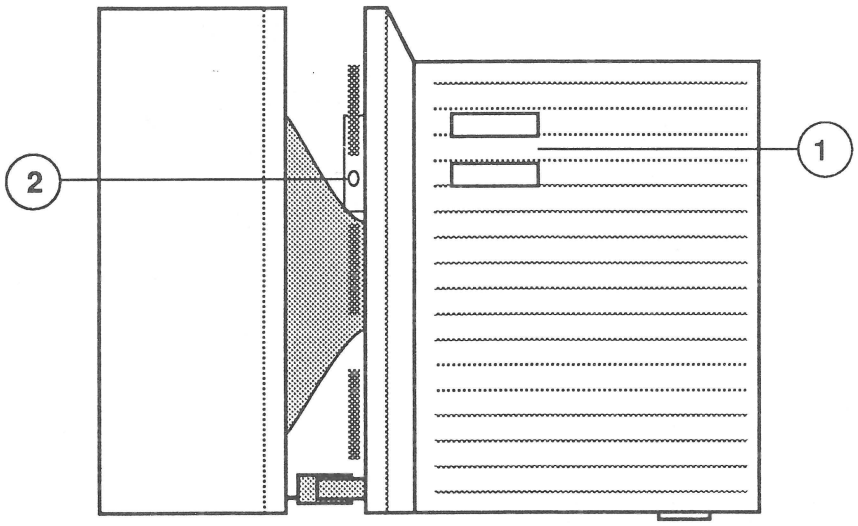

FIGURE 2

CAUTION: *In the next step, separate the rear cover and the bezel gently. The rear cover is attached to the logic board by the wires to the switch case. Both parts could be damaged if separated forcefully.*

6. Gently slide the rear cover an inch or two away from the bezel as shown in Figure 2.

WARNING: *Avoid touching the CRT in any way, because the CRT is still fully charged.*

7. To separate the bezel from the rear case, first remove the switch case by removing the screw that holds it to the side of the rear cover (Figure 2, #2), and sliding the case forward out of the rear cover.

8. Slide the rear cover completely away from the monitor.

Replace

1. Replace the switch case in the rear cover and fasten it with its screw.

2. With the monitor standing upright, slide the rear cover onto the bezel. If it is difficult to align them, check that the AC cord screw has not forced its mounting plate too far to the left, and that the metal rails of the main logic board assembly are inside the guides on the CRT mounting plate.

3. Replace the four Phillips screws on the rear cover.

4. Push the front foot onto the tabs on the bottom of the bezel.

❑ DISCHARGING THE CATHODE-RAY TUBE (CRT)

Materials Required

Safety goggles
Foam pad (ungrounded)
Needlenose pliers
Alligator lead
New CRT discharge tool (part number **076-0381**)

WARNING: Before starting, read the safety precautions and the CRT discharge procedure in Section 8, CRT Safety, under the* You Oughta Know *tab. *Alternative instructions for discharging the CRT using the older version of the discharge tool (and/or a screwdriver) are given in that section.*

Discharge Procedure

1. **Remove your grounding wriststrap and jewelry and put on safety goggles before beginning!**

2. Remove the rear cover.

3. Set the monitor upright on the ungrounded foam pad, with the back facing you.

4. Attach the clip of the CRT discharge tool to any metal part of the chassis (Figure 3, #1).

5. Put one hand behind your back, and grasp the handle of the discharge tool with your other hand.

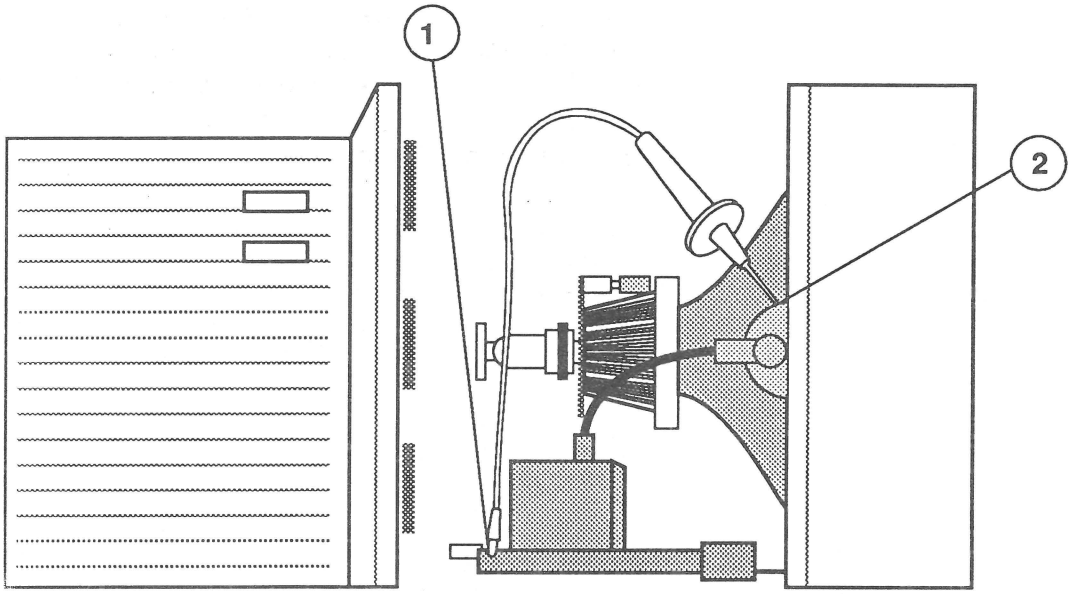

FIGURE 3

WARNING: *Use only one hand when discharging the CRT to prevent forming a path of current through your body should your hand slip and touch the metal part of the discharge tool during the discharge procedure.*

6. Hold the CRT discharge tool to the tube surface, and insert its probe under the anode cap (Figure 3, #2) until it touches the anode ring.

7. Remove the probe of the CRT discharge tool from under the anode cap and detach its clip from the metal chassis.

Note: A secondary charge could build up over time, even after you have discharged the CRT. To dissipate any residual charge, establish an ongoing ground by clipping one end of an alligator lead to the chassis frame and the other end to the anode ring or aperture.

Anode Cap

For some procedures, you may have to remove the anode cap. After you have discharged the CRT, peel back the anode cap until you can see the anode "ring" (or connector) at the center. Using needlenose pliers, compress the two prongs on the connector to free it from the anode aperture.

To replace the anode cap, press together the two prongs of the anode connector so that you can insert it into the aperture. Tug on the anode wire to make sure it is firmly seated, and then press down around the edges of the rubber anode cap to ensure a firm seal.

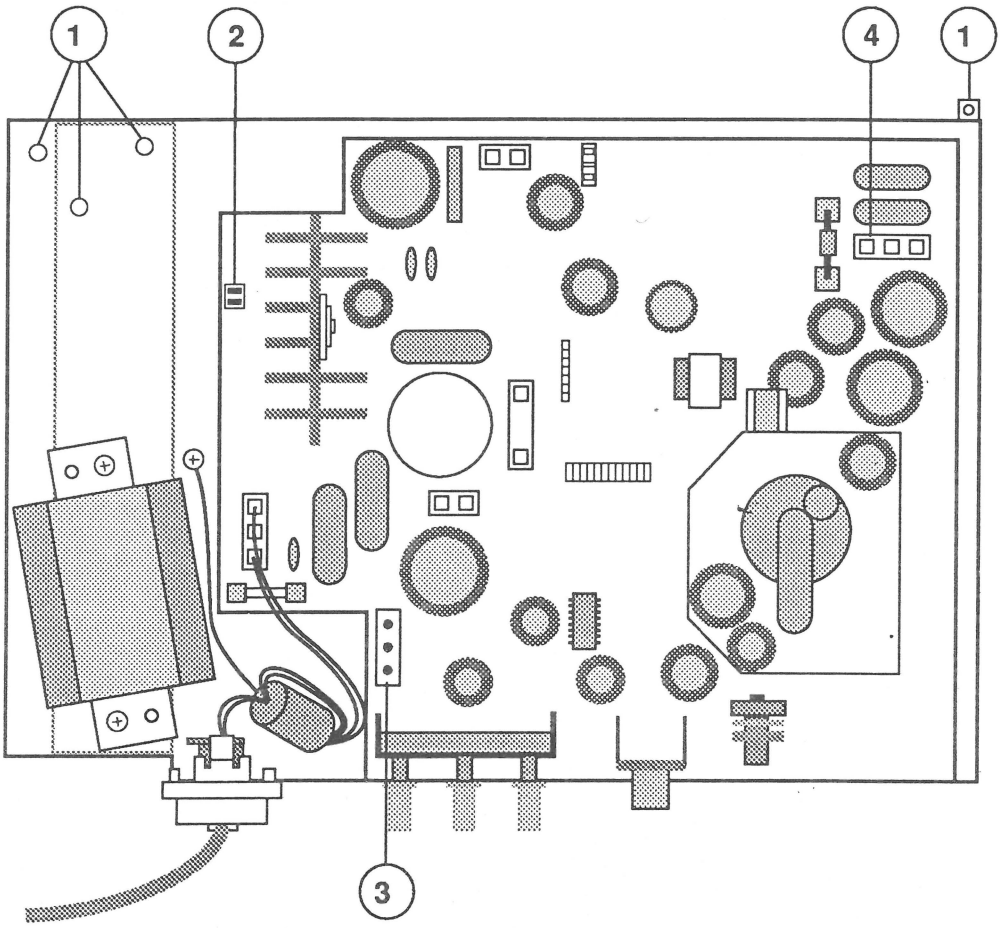

FIGURE 4

❑ MAIN LOGIC BOARD, SWITCH CASE, AND AC CORD

Materials Required

Medium Phillips screwdriver (magnetic)
Diagonal cutters
Safety goggles

Remove

1. Turn off the monitor, disconnect the AC cord from the wall outlet, and disconnect the video cable from the monitor.

2. Remove the rear cover (including front foot).

3. Discharge the CRT.

WARNING: *In the next step, be careful not to hit the CRT with the screwdriver when removing or replacing the screw nearest the CRT.*

4. Unscrew the four screws (Figure 4, #1) that fasten the main logic board assembly to the CRT mounting plate.

5. Remove wires from the wire clips.

6. Pull the main logic board assembly away from the CRT to give yourself more room to access the connectors.

7. Disconnect the pink/white LED wire (P5) from its connector (Figure 4, #2).

8. Disconnect the green/yellow yoke wire (P3) from the main logic board (Figure 4, #3).

9. Disconnect the red/blue yoke wires (P4) from the board (Figure 4, #4).

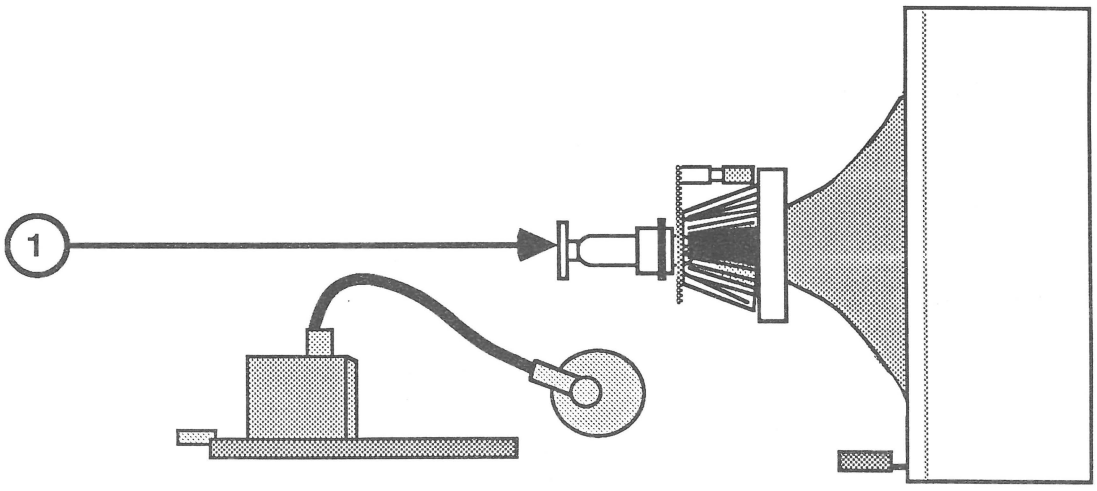

FIGURE 5

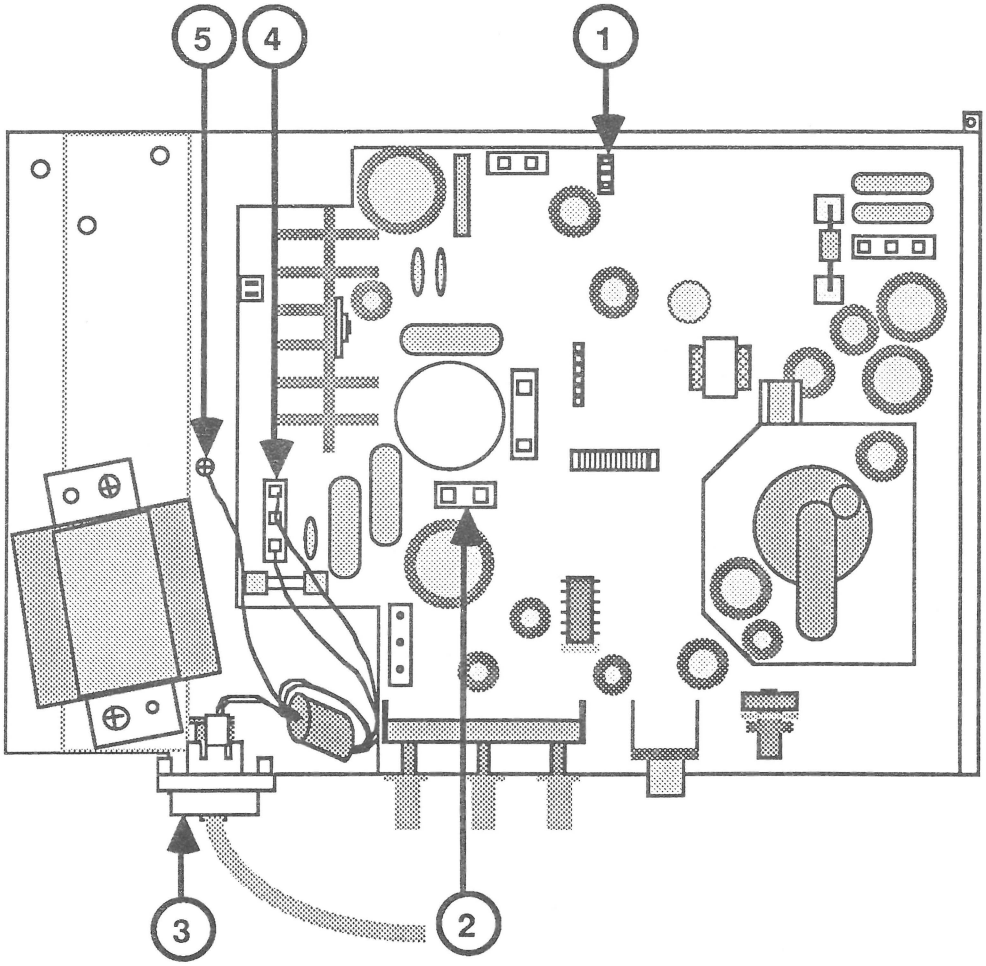

FIGURE 6

10. Gently pull the CRT socket board from the end of the CRT neck (Figure 5, #1).

11. Disconnect the gray ground wire (P6) from its connector on the CRT socket board. Move the logic board away from CRT.

12. The complete assembly consists of the board, the flyback transformer, and the metal chassis that holds them. The transformer is a separate part.

    If you are only removing the main logic board so that you can change the LED or the CRT, leave the switch case, AC cord, and transformer attached to the board.

    If you are replacing the main logic board, remove the adjustment knobs, the switch case, the AC cord, and the transformer before sending the main logic board assembly back to Apple.

Remove Switch Case and AC Cord

1. To remove the switch case from the board:

   a) Disconnect the contrast control connector (P8) from the board (Figure 6, #1).

   b) Disconnect the orange on-off control connector (P7) (Figure 6, #2).

2. To remove AC cord assembly from the board:

   a) Unfasten the screw holding the AC cord mounting plate to the case and lift the mounting plate out of the case (Figure 6, #3).

   b) Cut the tie holding the ferrite core to the case.

   c) Unplug the AC input connector from the main logic board (Figure 6, #4).

   d) Unfasten the green ground wire (Figure 6, #5).

Replace

1. Install the adjustment knobs on the board.
2. Replace the transformer.
3. Set the main logic board close to the CRT unit, with the edge near the tabs and channels it will slide into (Figure 7).

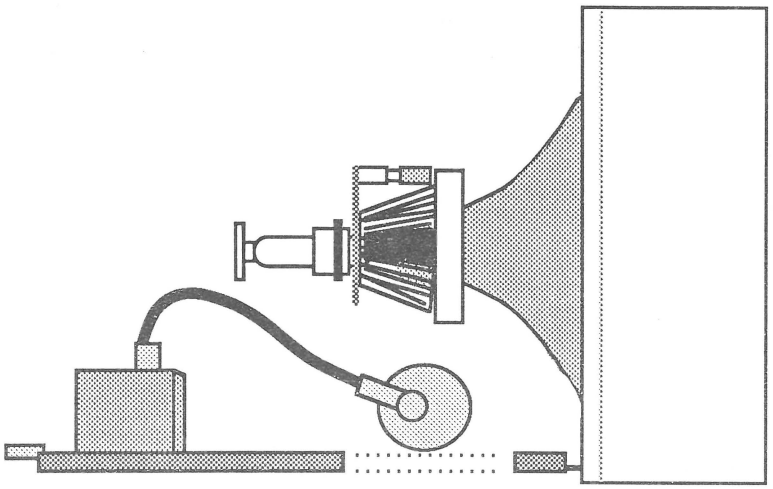

FIGURE 7

4. Reconnect the green/yellow yoke wire (P3) at J3 (Figure 8, #1).
5. Connect the red/blue yoke wire (P4) at J4 (Figure 8, #2).
6. Connect the LED wire at J5 (Figure 8, #3).
7. Connect the contrast control cable at J8 (Figure 8, #4).
8. Connect the orange on-off control wire to J7 (Figure 8, #5).

9. Slide the leading edges of the main logic board assembly carefully inside the metal channels in the CRT mounting plate. Push the edge of the assembly into the tabs in the CRT mounting plate.

***WARNING:** Be careful not to hit the CRT with the screwdriver when replacing or removing the screw closest to the CRT.*

10. Fasten the four screws holding the logic board assembly to the CRT mounting plate (Figure 8, #6).

11. Connect the gray ground lead from the CRT grounding wire to J6 on the CRT socket board.

12. Replace the CRT socket board on the neck of the CRT.

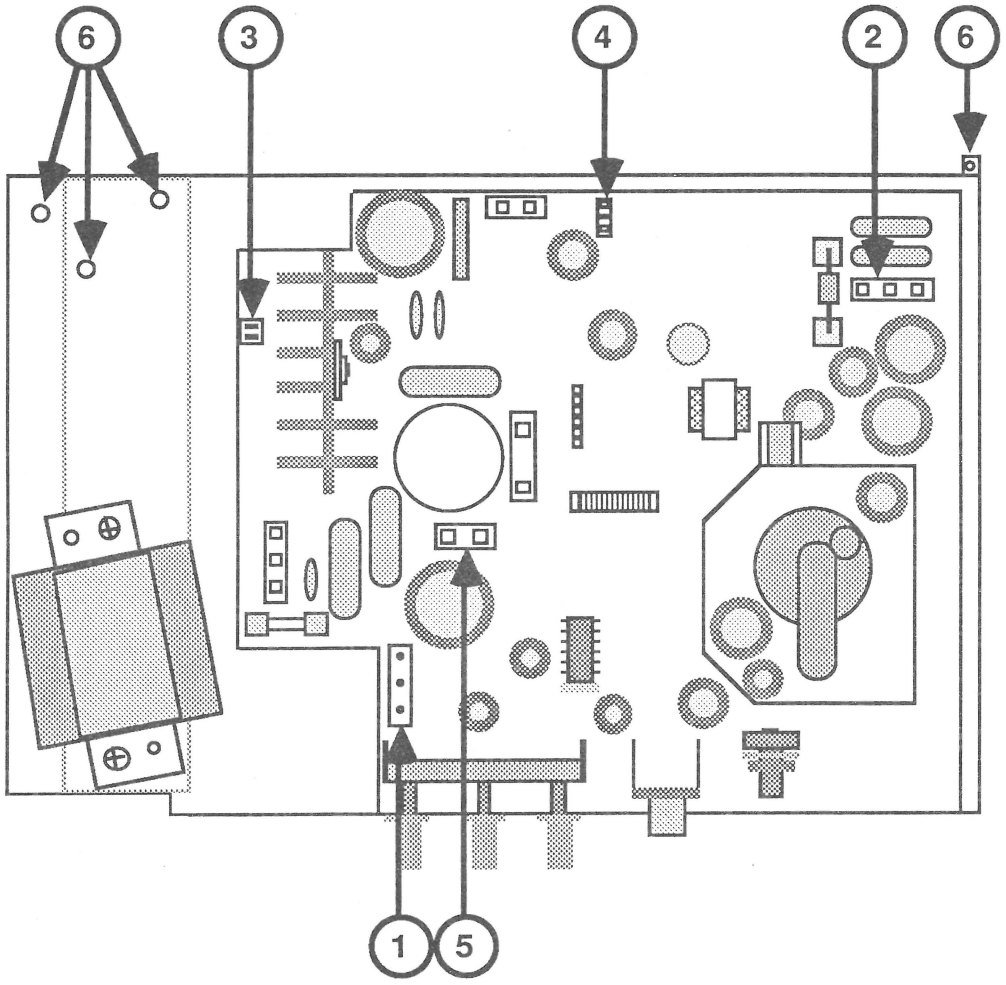

FIGURE 8

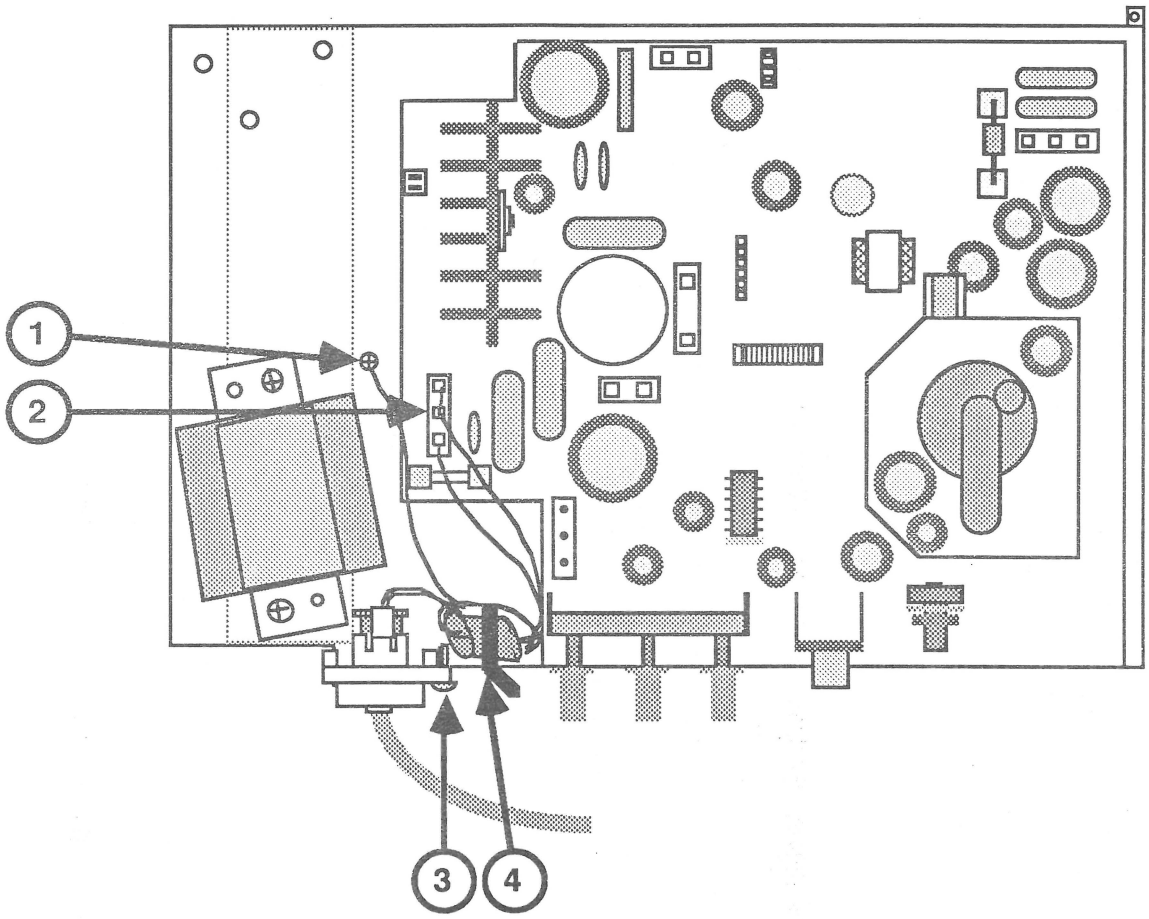

FIGURE 9

WARNING: Reattach the ground wire before making any tests involving power!

13. To reattach the AC cord:

    a) Attach the ground wire to the metal chassis near the transformer (Figure 9, #1).

    b) Plug the connector into the logic board (Figure 9, #2).

    c) Position the plug in back edge of case, and fasten the screw (Figure 9, #3).

    d) Fasten a piece of cable tie around the ferrite core, through the hole in the back edge of the case (Figure 9, #4).

14. Replace wires and cables in plastic clips.

15. If you are finished working inside the case, reconnect the anode cap to the anode of the CRT, making sure that both metal clips are in correctly.

16. To test that connectors P3 and P4 are correctly attached, hook up the monitor and computer, plug them in, and turn them on.

    a) If the image is upside down, turn the computer off and disconnect it. Discharge the CRT. Reverse connector P3.

    b) If the image is reversed, left to right, turn the computer off and disconnect it. Discharge the CRT. Reverse connector P4.

17. Replace the rear cover (includes switch case).

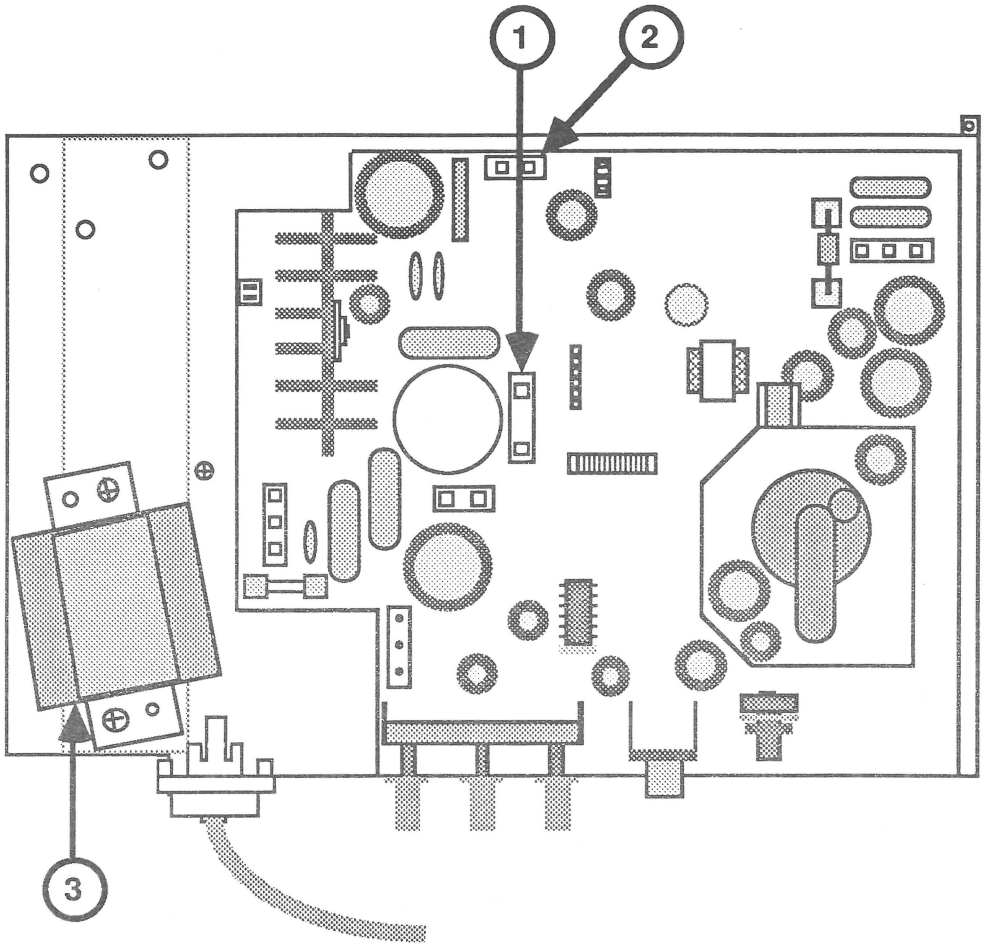

FIGURE 10

❑ TRANSFORMER

Materials Required

Medium Phillips screwdriver (magnetic)
Safety goggles

Remove

1. Remove the rear cover.
2. Discharge the CRT.
3. Remove the main logic board.
4. Disconnect the black and white wires' connector (P1) (Figure 10, #1). (Do not press hard on the board.)
5. Disconnect the blue wires' connector (P2) (Figure 10, #2).
6. Remove the mounting screws for the transformer (Figure 10, #3).
7. Remove the transformer from the main logic board.

Replace

1. Connect P1 at J1 (Figure 10, #1).
2. Connect P2 at J2 (Figure 10, #2).
3. Screw the transformer to the metal chassis.
4. Replace the main logic board.
5. If you are finished working inside the case, reconnect the anode cap to the anode of the CRT, making sure that both metal clips are in correctly.
6. Replace the rear cover.

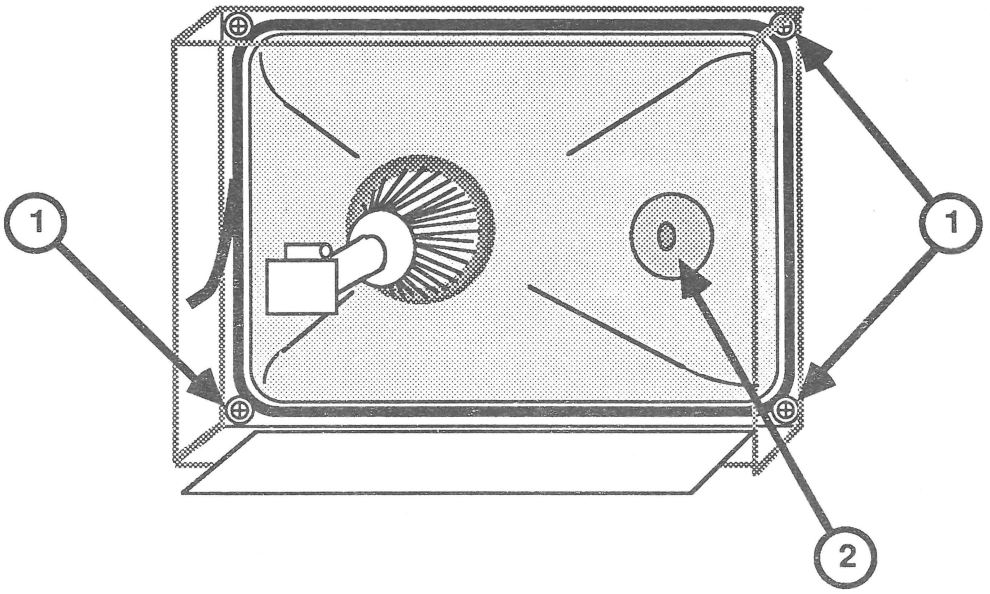

FIGURE 11

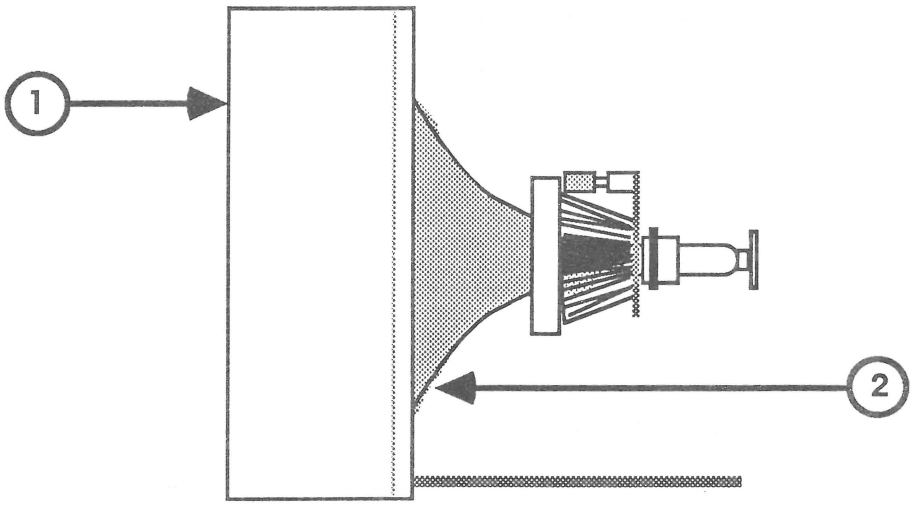

FIGURE 12

❑ CATHODE-RAY TUBE (CRT)

You may have to flex the monitor case somewhat as you slide the CRT out. This flexing is necessary to allow the rim of the CRT to pass the reinforcing bar on the bottom of the case. If you flex the case, do not let the CRT rim strike the bar.

Materials Required

Medium Phillips screwdriver (magnetic tip)

Remove

1. Turn off the monitor, disconnect the AC cord from the wall outlet, and disconnect the video cable from the monitor.
2. Remove the rear cover.
3. Discharge the CRT.
4. Remove the main logic board.
5. Place the CRT face-down on a soft surface. Remove the mounting screws (Figure 11, #1) from the four corners of the CRT. Avoid touching the anode opening (Figure 11, #2).
6. Stand the monitor upright and support it with both hands (Figure 12, #1 and #2).
7. Tip the CRT so that its weight shifts onto your hand. The CRT mounting plate may also slip out under your hand.
8. Lay the bezel flat and put the CRT down safely.

WARNING: *If you intend to dispose of the CRT, refer to "Disposing of the Cathode-Ray Tube" in Section 8, CRT Safety, under the* You Oughta Know *tab.*

Replace

If the ground wire installed on the new CRT comes off, look at the old CRT to see how to replace it.

1. Place the bezel flat. Slide the edge of the CRT mounting plate into the slots in the front of the case.

2. Push the four rubber mounting feet for the CRT on the spikes in the corners. Fasten with contact cement, if necessary.

***WARNING**: Do not force the rim of the CRT past the reinforcement bar.*

---

3. Holding the CRT in both hands, tip it slightly to slide its top edge under the mounting brackets.

4. Rest the top edge of the tube on its supports, then slip the rest of the CRT assembly into the case. It may be necessary to flex the case slightly.

5. With CRT still face down, replace the screws.

6. Replace the main logic board.

7. Replace the rear cover.

❑ FUSE

Materials Required

Small plastic flatblade screwdriver
Safety goggles

Remove

1. Unplug the AC cord.
2. Remove the rear cover.
3. Discharge the CRT.
4. If the wire inside the fuse is broken, remove the fuse. Insert a plastic adjustment tool or small plastic screwdriver under one metal end and gently pry up until you can pull the fuse out with your fingers.

Replace

1. Be sure you have the correct fuse.
2. Gently press the fuse into the clamp.
3. If you have finished working inside the case, reattach the anode cap.
4. Replace the rear cover.

❑ POWER SWITCH

Materials Required

Medium Phillips screwdriver
Safety goggles

Remove

1. Remove the rear cover and the switch case.
2. Discharge the CRT.
3. Remove the four screws holding the main logic board assembly to the CRT mounting plate.
4. Back the main logic board assembly away from the CRT.
5. Disconnect the switch case from the main logic board by unplugging the power switch connector (P7).
6. On the switch case, unfasten the screw holding the power switch.
7. Unwind the wires from the wire clips, noting how they are wrapped.
8. Pull the button off the shank, and lift the switch out of the case. Keep the button.

Replace

1. Insert the shank through the slot in the switch case. Place the switch so the wires point directly from it to the wire clip.
2. Slip the orange wires between the wire clips on the back of the switch case.
3. Attach the screw.
4. Push the switch button onto the shank (parallel to the contrast knob).
5. Replace rear cover and switch case.

❑ CONTRAST CONTROL

Materials Required

Medium Phillips screwdriver
Flatblade screwdriver
7/16" hex nut driver
Safety goggles

Remove

1. Remove the rear cover and the switch case.
2. Discharge the CRT.
3. Remove the four screws holding the main logic board assembly to the CRT mounting plate.
4. Pull the main logic board assembly away from the CRT.
5. Disconnect the switch case from the main logic board by unplugging the contrast control connector (P8).
6. Slide a flat screwdriver blade through the slots in the switch case and release both the latches that hold the contrast control knob (Figure 13, #1).
7. Swing the wheel section away from the case (Figure 13, #2).

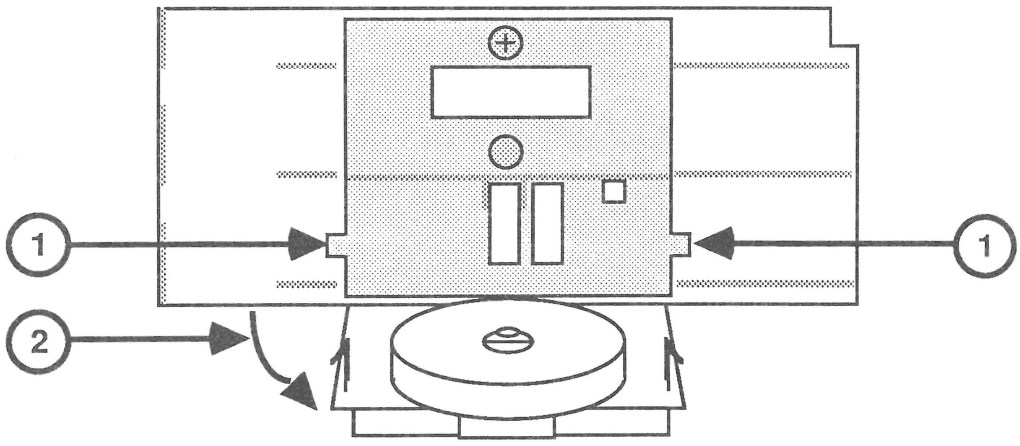

FIGURE 13

8. Slide the contrast control knob off its stem.

9. Remove the nut and washer with a 7/16" hex nut driver.

10. Slide the contrast control stem out of the hole in the switch case.

Replace

1. Remove the nut and washer from the replacement contrast control.

2. Insert the contrast control stem through the hole in the side of the switch case so that the small tab fits into the slot on the side of the switch case.

3. Replace the washer and nut on the stem. Tighten carefully so that the small tab is not twisted out of the slot.

4. Slide the plastic wheel onto the stem with its rim toward the side of case and the flat side of the wheel toward the inside of the case.

5. Close the switch case, snapping both latches shut.

6. Replace the contrast control connector at J8.

7. Fasten the main logic board assembly to CRT mounting plate.

8. Replace the rear cover.

❑ LED ASSEMBLY

Materials Required

Medium Phillips screwdriver
Safety goggles

Remove

1. Remove the rear cover.
2. Discharge the CRT.
3. Remove the main logic board.
4. Remove the CRT.
5. Remove the screw from the LED board. Lift the LED assembly out of the case.

Replace

1. Position the LED assembly so the deflection shield fits inside the rim on the bezel. Fasten the screw.
2. Replace the CRT.
3. Replace the main logic board.
4. Replace the rear cover.

❑ BEZEL

Materials Required

Medium Phillips screwdriver
Safety goggles

Remove

1. Remove the rear cover.
2. Set aside the front foot to install on new bezel.
3. Discharge the CRT.
4. Remove the main logic board.

   Note: If the foot is on, support the CRT carefully until you finish disconnecting.

5. Remove the CRT. Keep the CRT mounting plate for use in the new case.
6. Unfasten the screw that holds the LED assembly.
7. Remove the brackets for the rear cover screws and keep them to install in the new case.

Replace

1. Fasten the mounting brackets into the new bezel.
2. Replace the LED assembly.
3. Replace the CRT.
4. Replace the main logic board.
5. Replace the rear cover.

Apple Technical Procedures

Monochrome Monitor

Section 3 – Adjustments

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3.3 Introduction
3.4 Important Safety Instructions
3.5 Pre-Adjustment Set-Up Procedure
3.5 Materials Required
3.7 Adjustments
3.7 Materials Required
3.7 Sub-Brightness
3.9 Horizontal Hold
3.9 Focus

❑ INTRODUCTION

In exceptional circumstances, the pre-aligned CRT assembly may need adjustment following the replacement of the main logic board or other modules. After any such service, check the text and graphics production by viewing any program generating text and graphics.

Do Not Adjust the Yoke

All yoke adjustments have been preset by the manufacturer. Do not attempt to make any tilt, ring, or geometric adjustments on the Monochrome Monitor. If the customer's monitor has adjustment problems that the following procedures will not correct, use the procedures found in the Troubleshooting Section to isolate the faulty module, and return that module to Apple for repair.

Location of Controls

The contrast control is located on the side of the monitor, beneath the on-off switch. Three other adjustment controls are located on the rear panel of the monitor so that both the dealer and the customer can reach them. The only internal adjustments are sub-bright, horizontal hold, and focus. The focus should **very rarely** need adjustment.

❑ IMPORTANT SAFETY INSTRUCTIONS

***WARNING**: Read and follow the safety instructions below. Failure to follow them could result in electrical shock.*

1. During these adjustments your hand will come close to extremely high voltages on the tube, anode, anode lead, and yoke wires (Figure 1, #1, #2, #3, and #4). Avoid touching these parts.

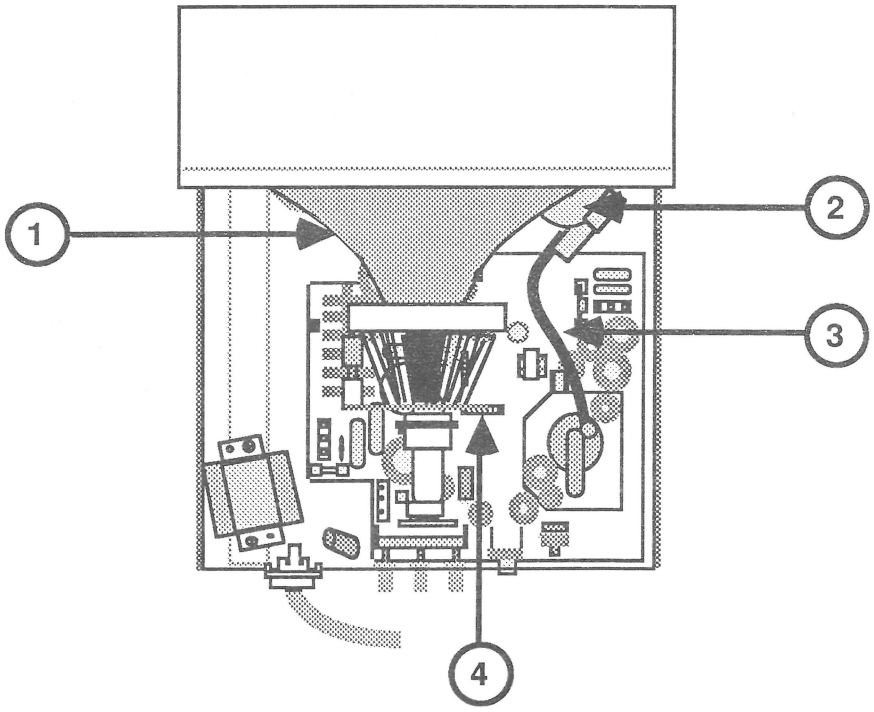

FIGURE 1

2. Use only one hand to make all adjustments! Never touch the chassis while making adjustments.

3. Use only a three-prong, grounded, electrical outlet installed by a qualified electrician, and **do not under any circumstances use an adapter plug**.

4. Do not attempt to make any adjustments on the monitor other than those directed in this section, and do those with extreme caution.

5. Read and follow the additional Safety Precautions in the Basics Section for this product.

❑ PRE-ADJUSTMENT SET-UP PROCEDURE

Materials Required

Apple Monochrome Monitor
Apple IIGS™ or Apple IIe computer
Apple IIGS Diagnostics Diskette (5.25" or 3.5" format)
Mirror with prop (for viewing screen during adjustments)

Procedure

1. Turn the monitor off and disconnect the power cord.

2. Disconnect the video cable from the back of the monitor.

3. Remove the back case. (See Section 2, Take-Apart.)

4. Set the monitor on its feet, reconnect the power cord and video cable, and turn on the monitor and computer.

5. Allow the monitor to warm up for at least 15 minutes.

6. Prop the mirror in front of the screen so that you can see the results of your adjustments as you work.

7. Use **Video Pattern Tests** on the *Apple IIGS Diagnostics Diskette* (see Section 3, Diagnostics, in *Apple IIGS Technical Procedures*,).

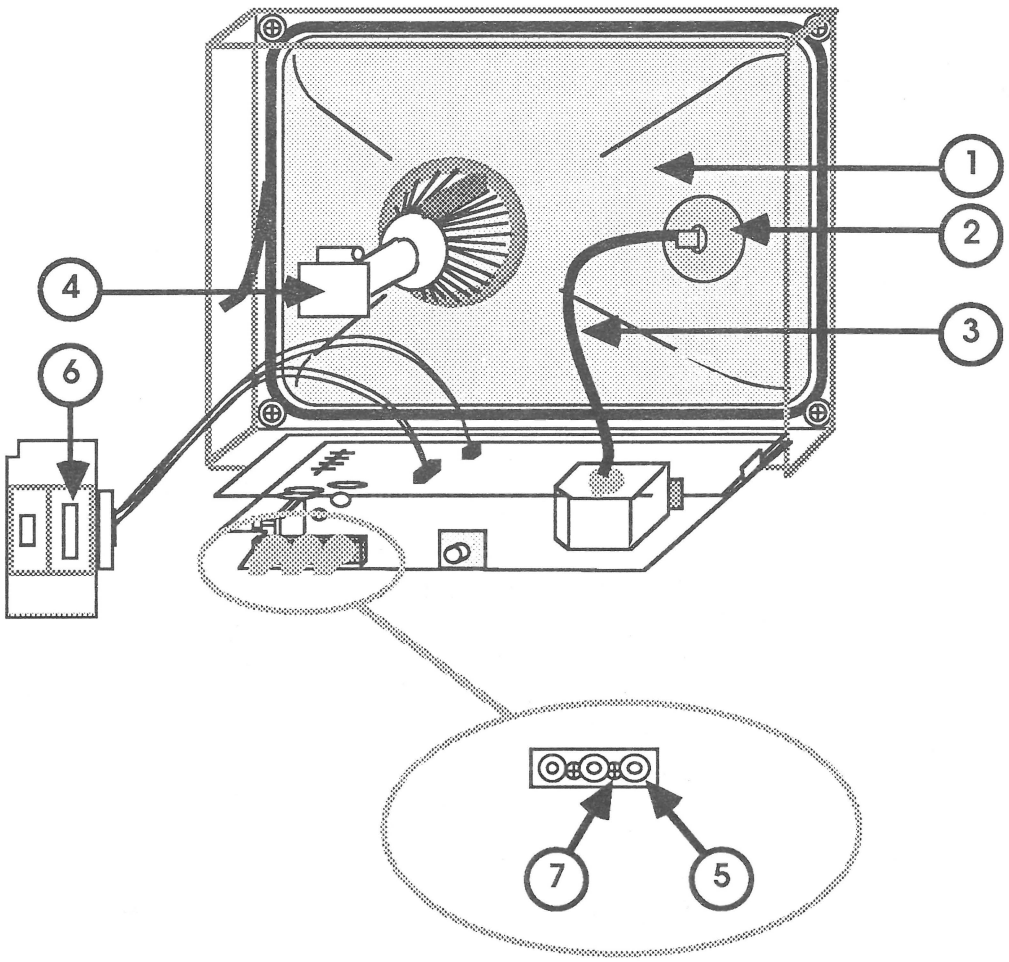

FIGURE 2

❑ ADJUSTMENTS

***WARNING**: There are extremely high voltages on the tube, the anode, the anode lead, and on ends of yoke wires (Figure 2, #1, #2, #3, and #4). DO NOT TOUCH THEM.*
Use only one hand to make all adjustments. Never touch the chassis with your free hand.

Materials Required

Plastic flatblade screwdriver (tweaker)
Apple IIGS Diagnostics Diskette (see *Apple IIGS Technical Procedures*, Section 3, Diagnostics)
Small piece of paper
Pen or soft pencil
Safety goggles

Sub-Brightness

1. Select **Hires Graphics Test** from **Video Tests.**
2. Turn the Brightness knob (Figure 2, #5) to make the screen as bright as possible.
3. Turn the Contrast knob (Figure 2, #6) to make the screen as bright as possible.
4. Using a plastic flatblade screwdriver, turn the Sub-Brightness control (Figure 2, #7) until you can see the slanted raster lines on the screen.
5. Turn the Sub-Brightness control down until the raster lines disappear.
6. Turn both the Brightness and Contrast controls down slightly, to adjust the screen for normal viewing.

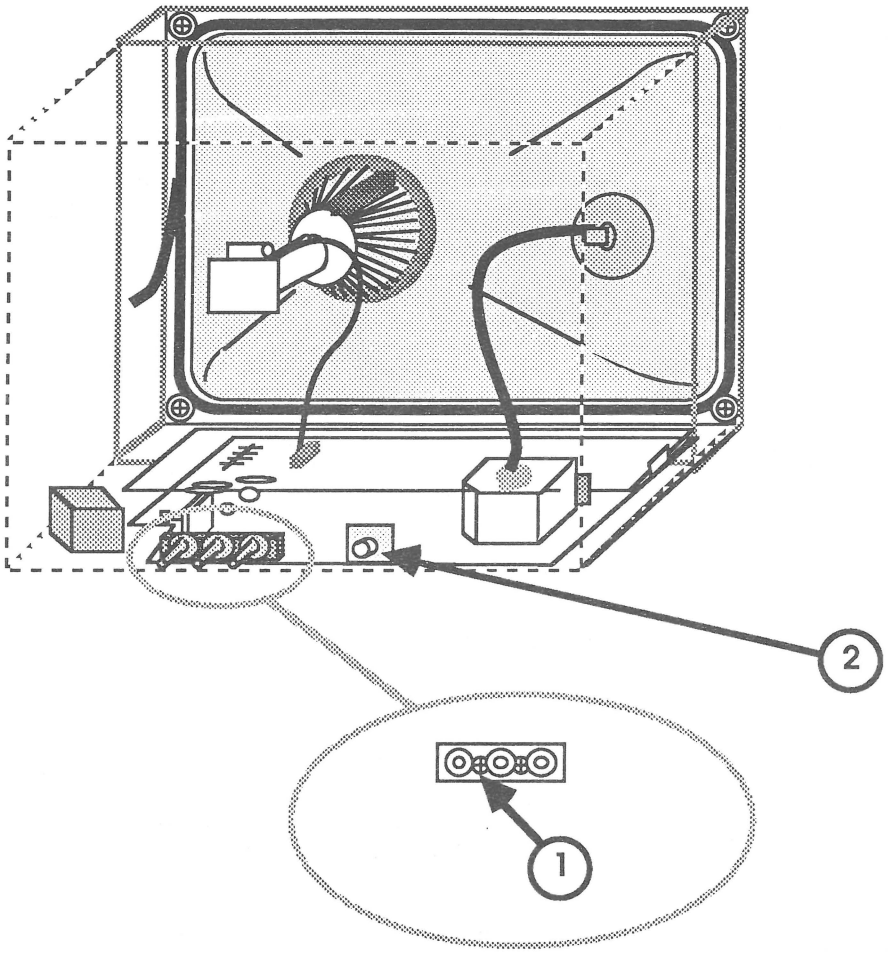

FIGURE 3

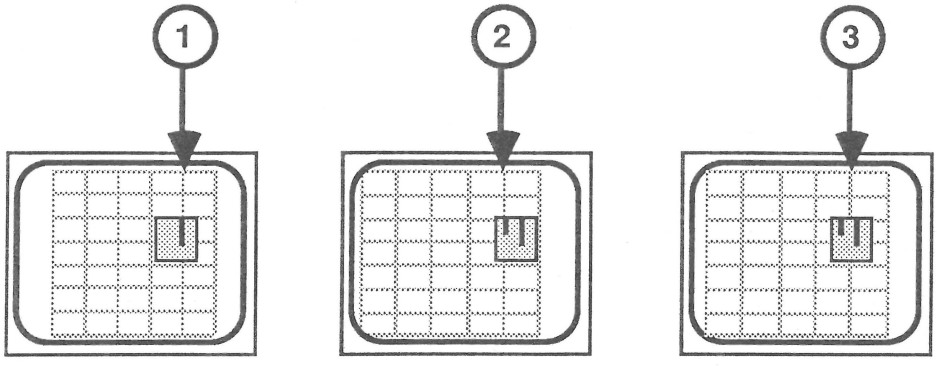

FIGURE 4

Horizontal Hold

1. Select **Hires Graphics Test** from **Video Tests**.
2. Turn the horizontal hold control (Figure 3, #1) **clockwise** until the screen goes out of synchronization.
3. Turn the control **counter-clockwise** until the screen becomes normal.
4. Choose a vertical line as a reference. Tape a piece of paper on the screen and make a mark on it at your reference line (Figure 4, #1).
5. Continue turning the control **counter-clockwise** until the horizontal synchronization again goes bad.
6. Turn the control **clockwise** again to correct the screen condition, and stop.
7. At the point where the synchronization becomes good, mark where your reference line is now. (Figure 4, #2 shows the screen in the mirror.)
8. Turn the horizontal hold control until the vertical line on the screen is halfway between the two marks (Figure 4, #3).

Focus

You should almost never have to adjust this control.

1. Use either display from **40/80 Column Text Test**.
2. Insert plastic flatblade screwdriver (tweaker) in Focus control (Figure 3, #2) and twist slightly to either side to improve focus.
3. If focus does not improve, replace CRT (See Section 2, Take-Apart).

Apple Technical Procedures

Monochrome Monitor

Section 4 – Troubleshooting

❑ CONTENTS

4.2 Introduction
4.2 Monochrome Monitor Symptom Chart

❑ INTRODUCTION

This section contains a symptom chart showing common problems and their solutions. Find the best description of your defective monitor, and then try the recommended actions in the order listed.

If the first corrective action does not solve the problem, put back the original module or part before trying the next action.

❑ MONOCHROME MONITOR SYMPTOM CHART

• *No power (LED doesn't light)*	1. Check fuse; replace if blown. If it blows again, replace transformer. 2. Replace transformer. 3. Replace power switch.
• *No raster*	1. Check that video cable is securely connected. 2. Adjust the external brightness control on the back of the case. 3. Adjust the contrast control. 4. Check that all connectors are secure on the CRT board and the main logic board. 5. Replace main logic board. 6. Replace CRT.
• *One vertical raster line appears*	1. Replace main logic board. 2. Replace CRT assembly.
• *Raster deformed*	- Replace CRT assembly.
• *Wavy picture*	- Replace main logic board.
• *Spot remains with unit off*	- Replace main logic board.
• *Brightness range abnormal*	1. Replace main logic board. 2. Replace power transformer.

• *Raster size small, picture abnormally bright*	- Replace main logic board.
• *No vertical synchronization*	- Replace main logic board.
• *Screen bright, no picture*	- Replace main logic board.
• *15 or more seconds for picture to appear*	- Change CRT assembly.
• *Picture appears and disappears*	1. Replace main logic board. 2. Replace CRT assembly.
• *Out of focus*	- See "Focus" in Section 3, Adjustments.
• *Won't focus*	1. Replace main logic board. 2. Replace CRT.
• *Narrow raster*	- Replace main logic board.
• *Picture compressed or stretched out*	- Replace main logic board.
• *Picture tears*	- See "Horizontal Synchronization" in Section 3, Adjustments.
• *Image reversed (after servicing)*	- Yoke connector (P4) is plugged in backwards.
• *Image inverted (after servicing)*	- Yoke connector (P3) is plugged in backwards.

Apple Technical Procedures

Monochrome Monitor

Section 5 – Illustrated Parts List

❑ CONTENTS

5.3 Rear Cover Assembly (Figure 1)
5.5 CRT, Main Logic Board, and Transformer (Figure 2)
5.7 Bezel Assembly (Figure 3)
5.9 Other Parts (Figure 4)

The figures and lists in this section include all piece parts that can be purchased separately from Apple for the Apple Monochrome Monitor, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs Manual* for prices.

Note: Screw/Knob Set parts are included where applicable on Figures 1-3.

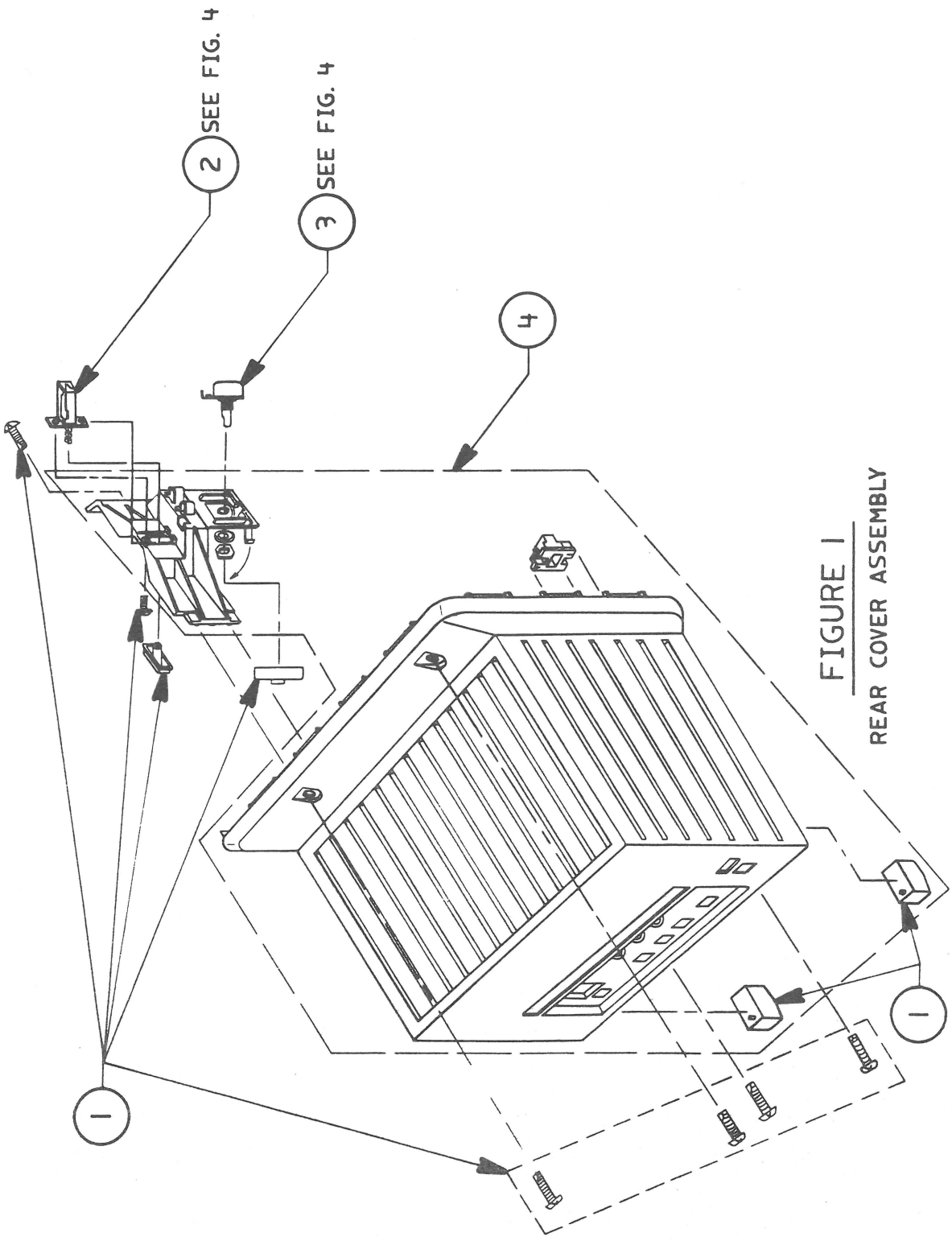

FIGURE 1
REAR COVER ASSEMBLY

❑ MONOCHROME MONITOR – REAR COVER ASSEMBLY (Figure 1)

Item	Part No.	Description
1	956-0004	Screw/Knob Set (See also Figures 2 and 3.)
2	937-0018	On/Off Switch
3	905-0002	Contrast Control
4	949-0068	Rear Cover Assembly

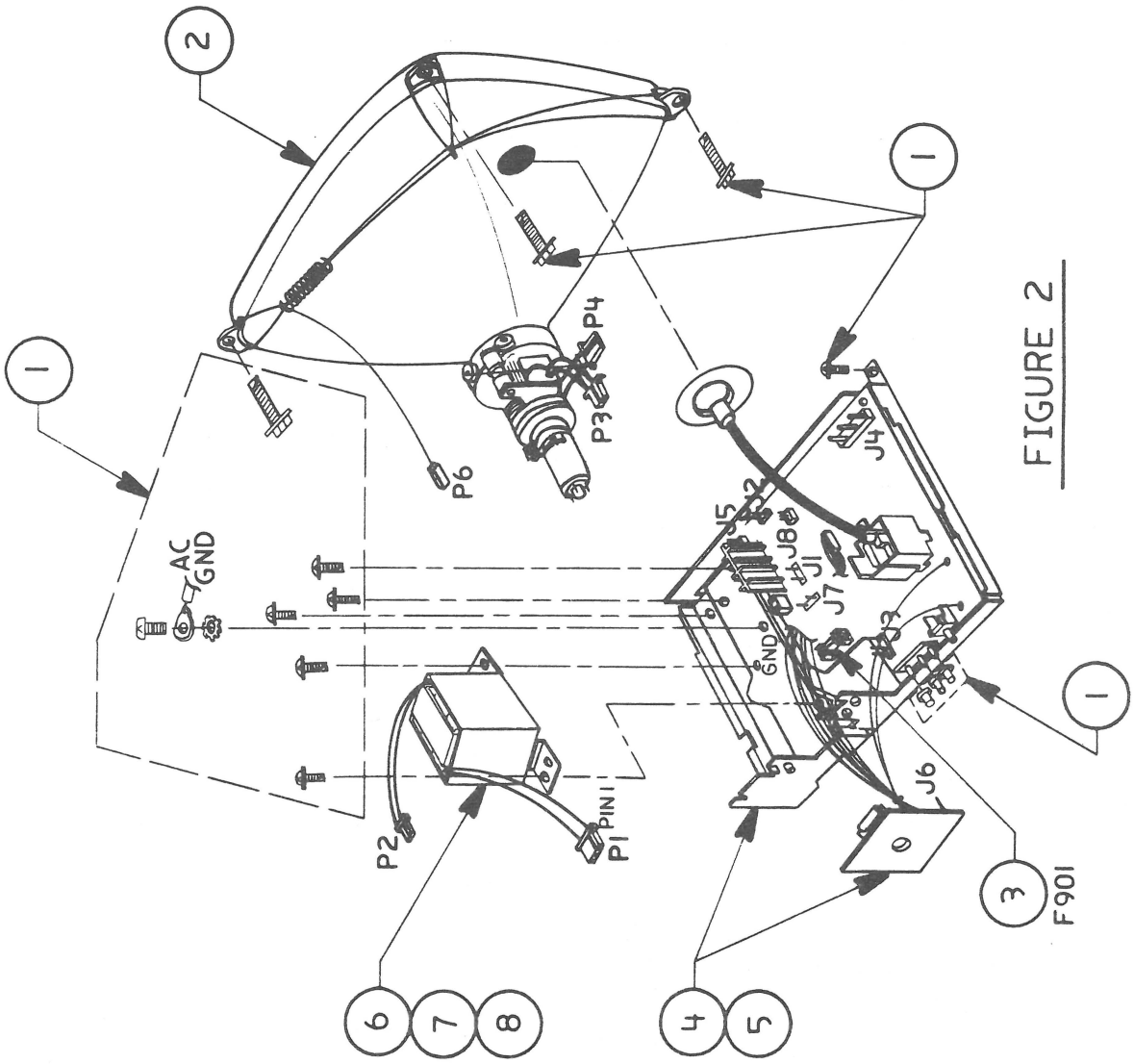

FIGURE 2

❑ MONOCHROME MONITOR – CRT, MAIN LOGIC BOARD, AND TRANSFORMER (Figure 2)

Item	Part No.	Description
1	956-0004	Screw/Knob Set (See also Figures 1 and 3.)
2	076-0224	CRT
3	740-0308	Fuse
4	661-0346	Main Logic Board, 110v
5	661-0362	Main Logic Board, 220/240v
6	915-0009	Transformer, 110v
7	915-0010	Transformer, 220v
8	915-0011	Transformer, 240v

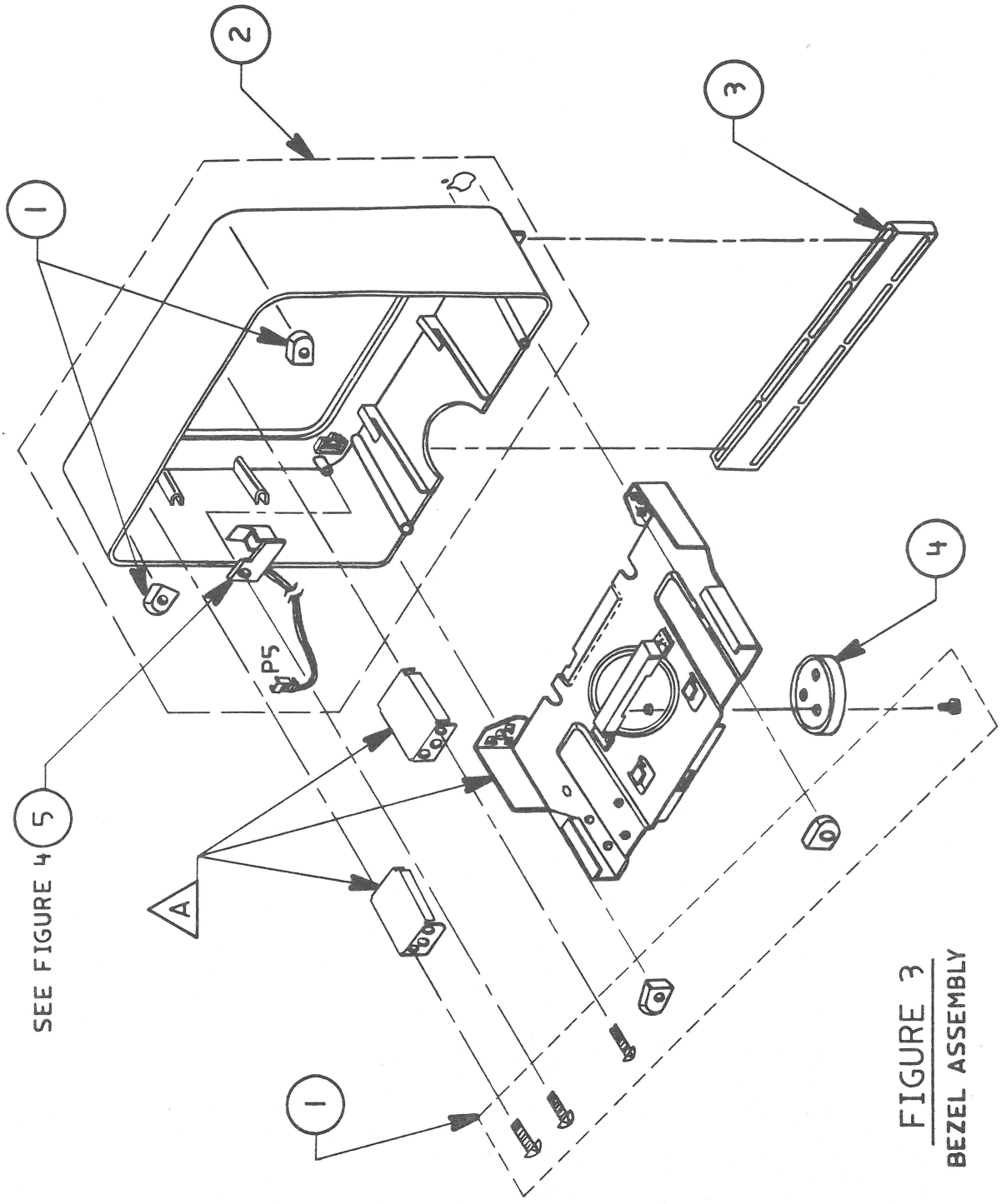

FIGURE 3
BEZEL ASSEMBLY

❑ MONOCHROME MONITOR – BEZEL ASSEMBLY (Figure 3)

Item	Part No.	Description
1	956-0004	Screw/Knob Set (See also Figures 1 and 2.)
2	949-0067	Bezel Assembly
3	949-0056	Front Foot
4	949-0057	Bottom Plate
5	930-0005	LED Assembly

Note: The items marked *A* are not available from Apple. If a new bezel is required, these parts must be retained from the old bezel and reinstalled in the replacement bezel.

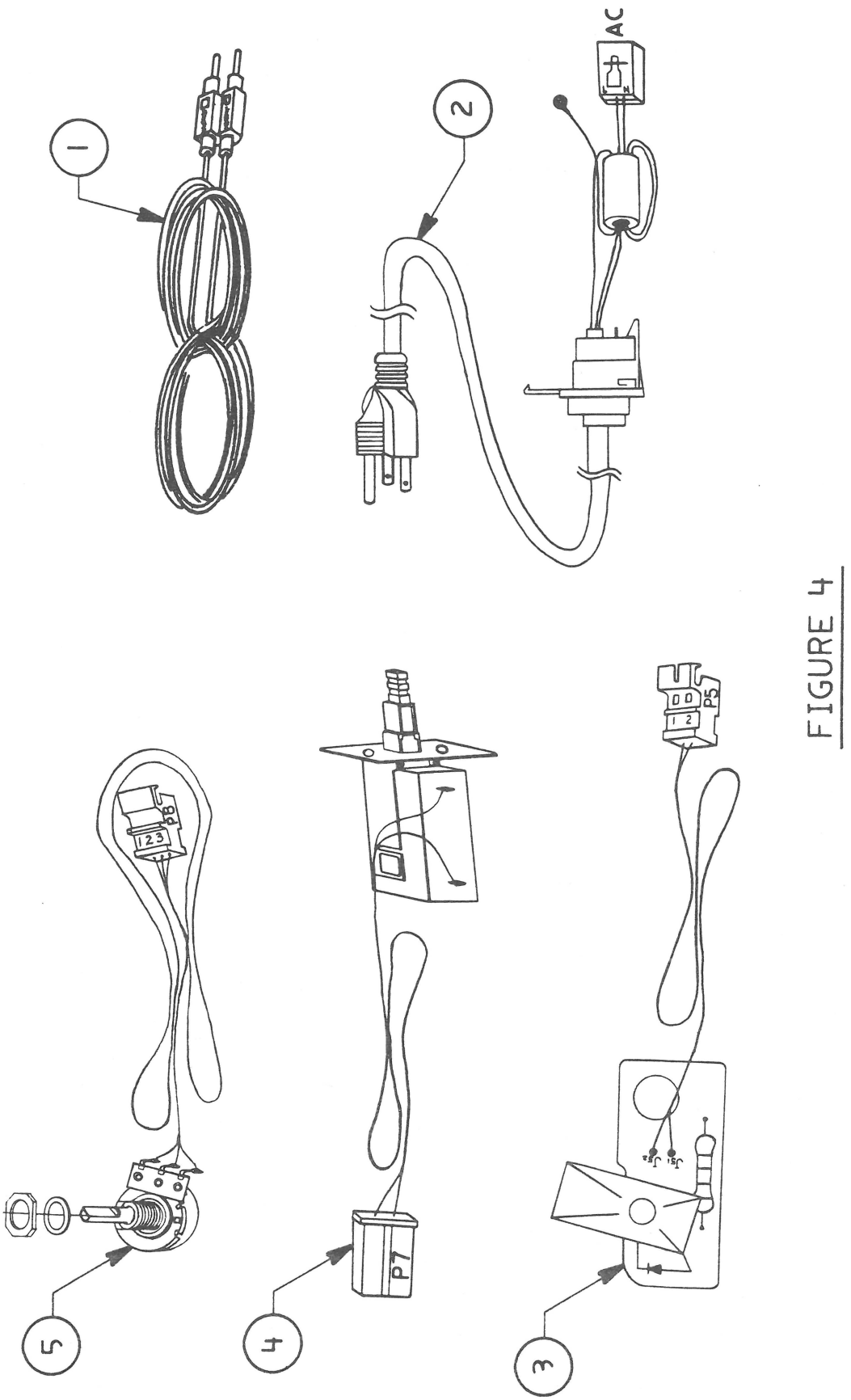

FIGURE 4

❑ MONOCHROME MONITOR – OTHER PARTS (Figure 4)

Item	Part No.	Description
1	590-0539	Video Cable, Smoke
2	935-0003	AC Cord
3	930-0005	LED Assembly
4	937-0018	On/Off Switch
5	905-0002	Contrast Control

Apple Technical Procedures

Apple II Family Cards

Technical Procedures

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IPL.5 AppleColor Card Cable (Figure 4)
IPL.7 SCSI Interface Card (Figure 5)
IPL.7 High-Speed SCSI Card (Figure 6)
IPL.9 Apple IIGS Video Overlay Card (Figure 7)
IPL.11 Apple II Language Card (Figure 8)
IPL.11 Apple II Workstation Card (Figure 9)
IPL.13 Apple II 3.5 Disk Controller Card (Figure 10)

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Apple Technical Procedures

Apple II Family Cards

Section 1 – SCSI Interface Card and High-Speed SCSI Interface Card

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1.13 ROM Level

❑ INTRODUCTION

Throughout this section, when we refer to the *interface card*, we are referring to both the SCSI Interface Card and the High-Speed SCSI Interface Card. Whenever we are referring to only one of the cards, we specify either the *SCSI Interface Card* or the *High-Speed SCSI Interface Card.*

The interface card allows computers of the Apple II family to communicate with peripheral devices that use the Small Computer System Interface (SCSI) standard. The card is inserted into a slot in the Apple IIe or Apple IIGS and is connected to a Hard Disk 20SC, a tape backup, or any other SCSI product. The interface card is supported by GS/OS, ProDOS and ProDOS-based applications.

In summary, the interface card provides

- High-performance parallel data transfer
- Ability to use all peripherals that utilize the industry-standard SCSI interface
- Expandability
- Connection to four external devices if running ProDOS 1.2 or higher
- Connection to up to seven external devices if running ProDOS 16 or GS/OS
- Direct Memory Access (DMA), which greatly speeds up information exchange (High-Speed SCSI Interface Card only)

❑ SETTING PRIORITIES AMONG DEVICES

Priority Numbers

A *priority number* is set for each SCSI device in a system, and the priority number sequence controls the accessing of all the SCSI devices that are connected. A separate priority number must be assigned to every SCSI device: one device, one number. This number prevents two devices from sending data at the same time, which could damage files already saved. With Apple II computers, the device with the highest priority number (7) is accessed first.

You set the priority of SCSI devices by some physical mechanism (which varies among devices). For exact instructions, consult the owner's manual of the specific peripheral you are connecting to the interface card.

The computer should be assigned top priority. That way, no matter when or where you want to retrieve a file, you can interrupt communication between any other devices, so your message gets through first.

The SCSI Interface Card should be set up as shown in Figure 1. The jumper (connector) should be on pins 8 and 9 for top priority (see Figure 1, #1).

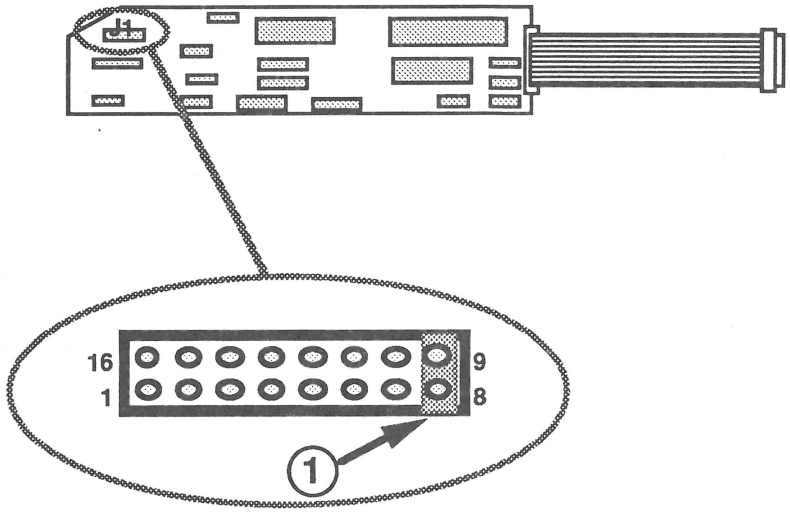


FIGURE 1

The High-Speed SCSI Interface Card should be set with all switches in the closed or down position, near the switch numbers as shown in Figure 2. This is how the card is shipped. The position corresponds to a SCSI ID of 7 with DMA on.

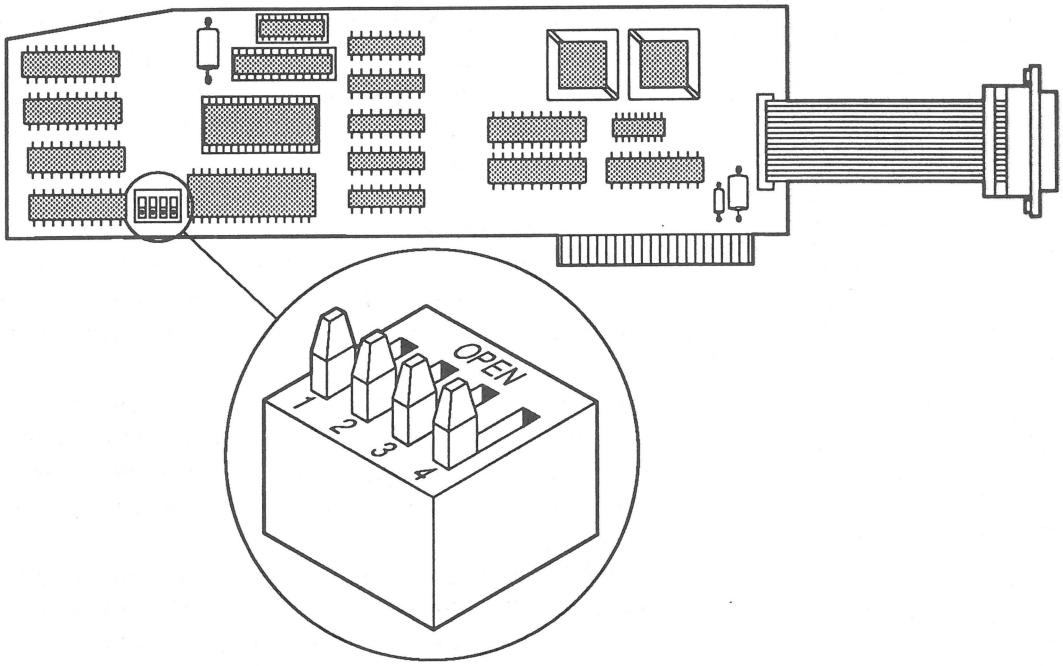


FIGURE 2

Rules for Configuring Devices

1. Connect the SCSI system cable to the interface card. **Never connect any other cable to the interface card!**

2. Make sure all the peripheral SCSI devices are daisy-chained to the interface card and are turned on. Make sure each connection is secure.

3. Be sure each SCSI device has its own assigned priority: 6, 5, 4, 3, 2, 1, or 0. Priority 7 is highest (reserved for the CPU); 0 is lowest.

4. To boot from the SCSI device automatically, the interface card must be in the highest slot.

❑ DIAGNOSTICS

General Information

This section describes the procedures for using the *Apple II SCSI Diagnostic* disk. With this diagnostic, you can choose which tests you wish to run and specify their sequence. You can also run a continuous test and keep a record of any error codes that occur. This record can be especially valuable when you are attempting to pinpoint the cause of intermittent failures.

Things to Remember

1. **Make a backup diagnostic disk before beginning!** When testing a defective interface card or Hard Disk 20SC, it is possible to erase or damage a section of the test disk. (The *System Utilities* disk is used for making a backup copy. Follow the instructions provided with *System Utilities.*)

2. Although the diagnostic will work with the card installed in any slot, we recommend that the interface card be installed in slot 2.

3. If you are running the diagnostic on an Apple IIe, you must have an Apple II Extended 80-Column Card installed.

4. If you are running the diagnostic on an Apple IIGS, you must set up the Control Panel correctly before connecting the SCSI loopback card. To set up the panel, hold down the <Option> key and switch on the system. Check the Control Panel to make sure the keyboard is set to **No buffering** and that **Your Card** is set for the slot where the card is installed (preferably slot 2).

5. If you are going to run a looping test that requires a loopback card, you must have the loopback card installed. If you do not, an alert box will tell you to switch off the system, install the card, and restart the system.

6. If you have a High-Speed SCSI Interface Card, the test will not run on the unenhanced Apple IIe. If you attempt to run the test, the screen will display an error message.

Materials Required

Apple II SCSI Diagnostic disk
Loopback cable for game port
SCSI loopback card
Apple IIe Extended 80-Column Card
Known-good Apple 5.25-inch or 3.5-inch drive
Apple IIGS or Apple IIe (IIe must be enhanced if you are testing a High-Speed SCSI Interface Card)
Interface card to be tested

Loopback Card

The DB-9 cable used to connect the SCSI loopback test card to the game I/O port **must** have wire #1 notched (see Figure 3, #1) to be fully compatible with the interface card. Once the cable is notched, it will work on either the Apple II family or the Macintosh family of computers.

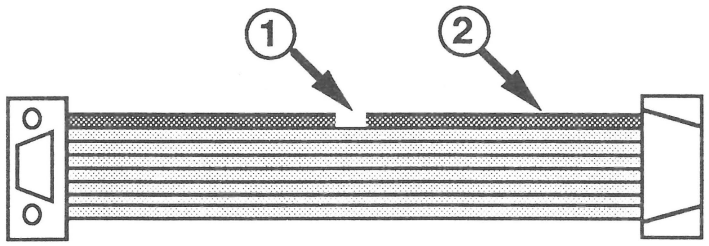


FIGURE 3

If the cable has **not** been notched, you must notch it by performing the following procedure:

1. Locate the colored (usually red) wire on one edge of the ribbon cable (see Figure 3, #2).

2. Cut a small piece, about 1/8 inch, from the colored wire. Be careful not to cut any other wire in the ribbon cable.

Installing the Loopback Card

To install the loopback card, connect one end of the notched DB-9 cable to the game I/O port on the Apple IIGS or the Apple IIe. Connect the other end of the notched cable to the loopback card connector labeled **TO MOUSE UNIT**. (Do not confuse the connector labeled **TO MOUSE UNIT** with the connector labeled **TO MOUSE CONN**). Connect the second, wider cable on the loopback card to the interface card.

***CAUTION:** Always power off the system when you connect or disconnect the SCSI loopback card.*

How to Make Selections

As you read the menu descriptions in the next section, keep in mind the following general rules for making menu selections:

1. To make a selection, press the letter of the menu item you wish, or use the arrow keys to highlight the name. Then press <Return>.

   As you make your selections on the **Choose Tests** menu, numbers will appear beside the selected tests. The numbers indicate the running order of the tests.

2. Press the letter of any item you wish to deselect, or use the arrow keys to highlight the name. Then press <Delete>. The Command key and <Delete> will delete all selections.

   When you deselect tests from the **Choose Tests** menu, the numbers that indicate the running order of the tests are corrected automatically.

3. To access the Help Screen, hold down the Command key and <Shift> and press ?.

4. If you must press a key to start the next test, use the <Spacebar>; do not use <Escape>. (Pressing <Escape> stops the testing.)

Test Selection Menu

The *Apple II SCSI Diagnostic* Test Selection Menu is shown below.

Please Select One of the Following:

a. Apple II SCSI Card Test
b. Apple II Hard Disk Test
c. Recommended Procedures
d. Quit

Apple II SCSI Card Test - Determines which interface card is installed and displays the menu containing the tests for the interface card.

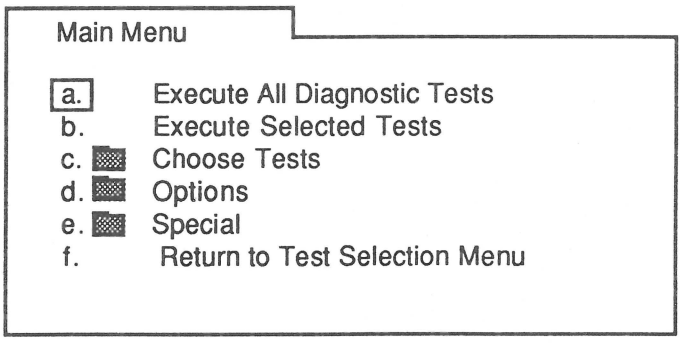
Apple II Hard Disk Test - Brings up the menu containing the tests for the hard disk (refer to Section 3, Diagnostics, for this information).

Recommended Procedures - Lists the sequence in which the diagnostics should be performed.

Quit - Displays a message to reboot the system.

Apple II SCSI Card Test

When **Apple II SCSI Card Test** is selected, the following Main Menu appears:



Execute All Diagnostic Tests - Runs all tests available for the interface card.

Execute Selected Tests - Allows you to run only the tests you indicate.

Choose Tests - Allows you to select the tests you want to run.

Options - Contains various selections that allow you to control how the test(s) are run.

Special - Contains various options for keeping track of errors generated.

Return to Test Selection Menu - Returns you to the Test Selection Menu.

Choose Tests

The **Choose Tests** folder contains the following tests:

RAM Test - Verifies that the RAM on the card is good.

ROM Test - Verifies that the ROM on the card is good.

SCSI Chip Test - Verifies that control signals are functional (requires SCSI loopback card).

Control Chip Test - Verifies that the registers on the chip can be written to and read from. This test is available only when the High-Speed SCSI Interface Card is installed (requires SCSI loopback card).

SCSI Bus Test - Verifies that all bus lines are functional (requires SCSI loopback card).

SCSI ID Jumper Test - Checks that the jumper (on the SCSI Interface Card) or DIP switch (on the High-Speed SCSI Interface Card) is set and that the jumper/switch can be read.

Options

When the **Options** folder is open, the following list of selections appears on the screen:

- Loop Tests Until Esc is Pressed
- Continue on Error Until Esc

If an option is selected, a check mark appears beside the item. To deselect an option, just select the same option again.

Special

The following selections appear when the **Special** folder is opened:

- Display Error Log - Displays the name of the test being run when an error is encountered on the screen.
- Clear Error Log - Erases the log from RAM.
- Clear Testing Status Line - Clears the iterations and failure counts displayed.
- Display Current System Status - Indicates the type of system, the ROM version, and the position of the jumper (on the SCSI Interface Card) or switch (on the High-Speed SCSI Interface Card).
- Load Selected Test Sequence from Disk - Loads the selected test sequence to RAM.
- Save Selected Test Sequence to Disk - Saves the selected test sequence to the disk so you can retrieve the test sequence later.

When any of the above items is selected and <Return> is pressed, the action is performed.

Running the Diagnostic

The diagnostic can be configured in various ways. All tests can be run in the default sequence, or selected tests can be looped or run in any order you specify.

Note: There may be a 15- to 20-second delay when booting the *Apple II SCSI Diagnostic.*

Note: You must set the Control Panel before connecting the SCSI loopback card to the interface card. Hold down <Option> and switch on the system. Verify that the keyboard is set to **No buffering** and that **Your Card** is set for the slot where the card is installed (preferably slot 2).

Standard Test

1. Install the loopback card. Connect one end of the notched DB-9 cable to the game I/O port on the Apple IIGS or the Apple IIe. Connect the other end of the notched cable to the loopback card connector labeled **TO MOUSE UNIT**. (Do not confuse the connector labeled **TO MOUSE UNIT** with the connector labeled **TO MOUSE CONN**). Connect the second, wider cable on the loopback card to the interface card.

***CAUTION:** Always power off the system before you connect or disconnect the SCSI loopback card.*

2. Insert the *Apple II SCSI Diagnostic* disk and switch on the system. Press the letter a or use the arrows to select **Tests for the Apple II SCSI Interface Card**, and press <Return>.

3. Press the letter a or use the arrows to select **Execute All Diagnostic Tests**, and press <Return>. If an error is encountered, the testing stops and a message indicates which test failed.

4. On completion, the message **Testing finished** displays.

Customized Test

1. Insert the *Apple II SCSI Diagnostic* disk and switch on the system. Press the letter a or use the arrows to select **Apple II SCSI Card Test**, and press <Return>.

2. Press the letter c or use the arrows to select **Choose Tests,** and press <Return>. Then highlight the tests you wish to run and press <Return>.

   If you wish to deselect a test, use the letters or arrows to select the test and press <Delete>.

3. On completion, return to the main menu, select **Execute Selected Tests,** and press <Return>.

   If an error is encountered, the testing stops and a message indicates which test failed.

4. On completion, the message **Testing finished** displays.

Continuous Test

A continuous (looping) test is available. Select the tests you wish to loop by following the instructions under "Customized Test." Follow the steps below to run a continuous test.

Note: When you stop a continuous test, the looping function is automatically turned off. You will have to reselect this function from the menu if you wish to run the continuous test again.

1. After you have chosen the tests you want to run, return to the main menu, select **Options,** and press <Return>.

2. From the menu, select **Loop Tests Until Esc** and press <Return>.

   A check mark should appear beside the selection.

3. Select **Continue on Error Until Esc** if you want to continue looping, regardless of errors, until <Escape> is pressed.

   If you do not select this, the testing will halt when an error is encountered.

4. Return to the main menu, select **Execute Selected Tests,** and press <Return>.

   The tests will run (depending on your selection in step 3) continuously until an error occurs or until <Escape> is pressed. If <Escape> is pressed, looping is canceled.

   If you press <Escape> to stop the testing, you can then check for errors by selecting **Special** and pressing <Return>.

   Select the video display for a listing of the errors encountered.

5. If you are going to run the test again, be sure to clear the error log and the status line from the Special menu before returning to the main menu.

❑ SCSI INTERFACE CARD ROM UPGRADE

To provide compatibility between the SCSI Interface Card and new Apple products, the SCSI Interface Card ROM has been revised. The new ROM has a new part number.

Inspection

If a crash occurs, and the SCSI Interface Card still passes the diagnostics, check the ROM part number. If the ROM chip at A3 is 341-0112A or B, upgrade it to a ROM chip with part number 341-0437A.

If you are using version 4.0 of the Apple IIGS Operating System, you must use the latest revision of the SCSI Interface Card. The latest revision of the SCSI Interface Card uses a ROM chip with part number 341-0437A.

ROM Level

1. Locate the old ROM chip at coordinate A3 on the SCSI Interface Card (Figure 4, #1).

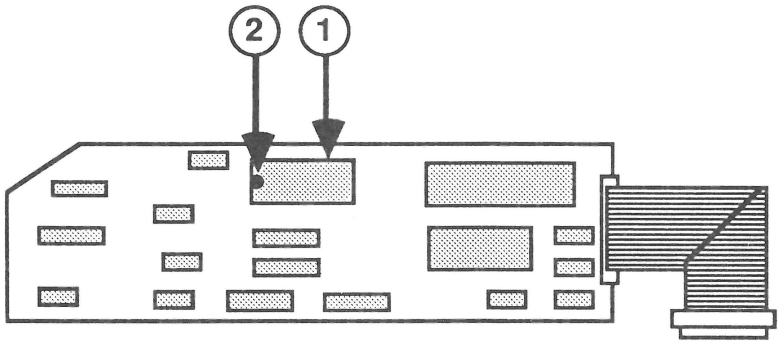


FIGURE 4

2. Remove the ROM chip with IC extractors. If it is difficult to remove, gently pry both ends up with a jeweler's screwdriver.

3. Position the new ROM chip on the socket. Be sure that the notch on the ROM (Figure 4, #2) is facing **away from** the cable on the SCSI Interface Card. Press the ROM firmly into the socket.

4. Run *Apple II SCSI Diagnostic* to verify the ROM.

Apple Technical Procedures

Apple II Family Cards

Section 2 – Apple II Video Overlay Card

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❑ INTRODUCTION

Terminology

A few terms need to be defined before beginning this section, which addresses Apple II Video Overlay Card.

The **Control Color** is software-selectable and is the color that will allow the NTSC signal to be seen. The NTSC signal will show through any area of the computer video displaying the selected control color.

Dissolve is the extent to which video and graphics pixels are mixed.

Genlock is a state reached when the graphics engine on Apple II Video Overlay Card has been synchronized to the operating frequency of an external video source.

The **NTSC** (National Television Standards Committee) is the group that defines the standards and controls governing television transmission and receiving. NTSC video is the 525-line video standard used for broadcasting in the US, Canada, and Japan.

Overlay is a process whereby the computer display is superimposed over an external NTSC source and is merged to produce both an RGB and a composite video signal.

General Overview

The Apple II Video Overlay Card provides Apple II family computers with NTSC-video genlock and overlay capabilities. The card uses a modified version of the Apple IIGS graphics circuitry. The card can genlock to an external video synchronization source or to another computer.

The Apple II Video Overlay Card requires very little software for basic operation. Initially the card will display the normal Apple II graphics that would have been visible on the system monitor. When an NTSC signal becomes available on the input connector, the card will attempt genlock. When the card and the NTSC video source have synchronized, the system will have achieved genlock and the Apple II graphics will overlay the NTSC video.

The overlay is controlled by either a desk accessory or an application. If control is not available, the default settings are:

- dissolve 100% external video on control color
- control color black and enabled
- genlock and overlay enabled

❑ STARTING THE SYSTEM

1. The Apple II Video Overlay Card can be used in the Apple IIGS or the Apple IIe. In the Apple IIGS, the card must be installed in slot 3; in the Apple IIe, the card can be installed in any slot.

2. Connect a monitor to the output connector on the card and turn on the power. The card will be activated automatically.

3. If you want to achieve overlay, switch off the system and apply an NTSC video signal source to the input connector on the Apple II Video Overlay Card. Switch on the system.

   When the Apple II Video Overlay Card and the NTSC signal become synchronized, the system has achieved genlock, and the NTSC video will be overlaid by the Apple II graphics.

❑ DIAGNOSTICS

General Information

This section describes the procedures for using the *Apple II Video Overlay Card* diagnostic. With this diagnostic, you can choose which tests you wish to run and specify their sequence.

Things to Remember

1. **Make a backup diagnostic disk before beginning!** The *System Utilities* disk is used for making a backup copy. Follow the instructions provided with *System Utilities.*

2. **To run the diagnostic, the Apple II Video Overlay Card must be in slot 3 on an Apple IIGS or in any slot on an Apple IIe. The Apple IIGS must have ROM 01 or higher, and the IIe must be enhanced to run the diagnostics.**

3. **You must have the NTSC loopback cable (a standard monitor cable) connected**. One end is connected to the input jack on the Apple II Video Overlay Card, and the other is connected to the output jack for composite video on the system being used. *Failure to install the cable will prevent the running of three of the card tests.*

4. Apple II Video Overlay Card is a complete module exchange. The cables are not part of the module exchange.

5. If you are running the diagnostic on an Apple IIe, you must have an Apple Extended 80-Column Card installed.

6. Some tests are specifically for the Apple IIGS. Do not run these tests on the Apple IIe.

Materials Required

Apple II Video Overlay Card Diagnostic disk
Extended 80-Column Card for the Apple IIe
Known-good Apple 3.25 Drive (or Apple 5.25 drive)
Apple IIGS or Apple IIe (enhanced only)
NTSC loopback cable (monitor cable)
Apple II Video Overlay Card to be tested

NTSC Loopback Cable

Connect one end of the monitor cable to the input jack on the Apple II Video Overlay Card, and the other to the output jack for composite video on the system being used. The monitor being used (composite or RGB) is connected directly to the card.

This loopback cable must be installed to run the Genlock Test, the Control Color Test, and the Hue/Color Control Test.

How to Make Selections

As you read the menu descriptions in the next section, keep in mind the following general rules for making menu selections:

1. To make a selection, press the letter of the menu item you wish, or use the arrow keys to highlight the name. Then press <Return>.

   As you make your selections on the **Choose Tests** menu, numbers will appear beside the selected tests. The numbers indicate the running order of the tests.

2. Press the letter of any item you wish to deselect, or use the arrow keys to highlight the name. Then press the <Delete> key.

   <Command> and <Delete> will delete all selections.

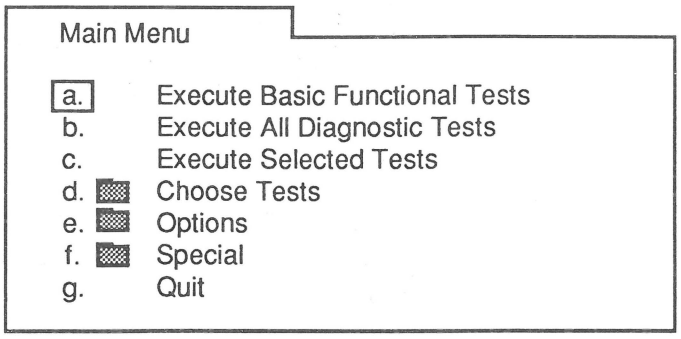
   As you make deselections from the **Choose Tests** menu, the numbers that indicate the running order of the tests are corrected automatically.

3. To access the Help Screen, hold down the <Command> and <Shift> keys and press ?.

4. If you must press a key to start the next test, use the <Spacebar>, not the <Escape> key. (Pressing <Escape> stops the testing.)

Tests for the Apple II Video Overlay Card

When the Apple II Video Overlay Card disk is started up, the following Main Menu will appear. *Execute Basic Functional Tests* is the default selection:



Execute Basic Functional Tests - Runs tests that verify that the card is operating. Performs the Apple II Video Overlay Card RAM Test (Apple IIGS only), Genlock Test, Register Test, Control Color Test, and Hue/Color Control Test.

Execute All Diagnostic Tests - Runs all tests available for the Apple II Video Overlay Card (some tests are for the IIGS only).

Execute Selected Tests - Allows you to run only the tests you indicate.

Choose Tests - This option is a folder that contains all the tests that can be selected for the Apple II Video Overlay Card.

Options - Contains various selections that allow you to control how the test(s) is run.

Special - Contains various selections for saving and tracking errors.

Quit - Leaves the program.

Choose Tests

The **Choose Tests** folder contains the following tests and additional folders:

Genlock Test - On an RGB monitor, this test displays text that will fade in and out of a red background. On a composite monitor, the text may be black and white. Loopback cable must be installed to run this test.

Control Color Test - This test displays some blocks of standard colors, and if an overlay signal is present, dissolves (places) a pattern of color bar into each block of color. Loopback cable must be installed to run this test.

Hue/Color Control Test - This test requires an NTSC input and an RGB output. It steps through a range of saturations and hues that test the on-board controls of this feature. Loopback cable must be installed to run this test.

RAM Page Select Test - This test verifies that both pages of Apple IIGS video RAM are available for display by displaying two different-colored screens.

Video Modes Tests Folder - This folder contains the following standard tests, also available on the Apple IIe or Apple IIGS diagnostic disk.

- 80/40-Column Test
- Lo-Res Graphics Test
- Hi-Res Graphics Test
- Double Hi-Res Graphics Test
- Super Hi-Res Graphics Test (Apple IIGS only)

There are two additional tests available: the Interlace Test and the Screen Color Test.

- The Interlace Test forces the card into the interlace mode. Lines of graphics are taken alternately from each RAM page.

- The Screen Color Test steps through the standard combinations of border, background, and text colors.

RAM/Register Folder - This folder contains the following two tests:

- The RAM test (Apple IIGS only) tests the RAM of the Apple II Video Overlay Card. The test takes about two minutes and the result—passed or failed—is reported. The screen does not have an indicator to determine whether it locks up.

- The Register Test tests the internal registers on the Apple II Video Overlay Card. The result—passed or failed—is reported.

Options

When the **Options** folder is open, the following list of selections appears on the screen:

- Loop Tests Until Esc
- Continue on Error Until Esc

If an option is selected, a check mark appears beside the item. To deselect an option, just select the same option again.

Special

The following selections appear when the **Special** folder is opened:

- Display Error Log - Displays a list of all errors encountered during test.
- Clear Error Log - Erases the log from RAM.
- Clear Testing Status Line - Clears the iterations and failure counts displayed.
- Display Current System Status - Indicates the type of system, the ROM version, and the amount of RAM.
- Load Selected Test Sequence from Disk - Loads a previously saved test configuration file.
- Save Selected Test Sequence to Disk - Saves the current test configuration to disk.

When any of the above items is selected and <Return> is pressed, the action is performed.

Running the Diagnostic

The diagnostic can be configured in various ways. All tests specifically for the Apple II Video Overlay Card can be run, or selected tests can be looped or run in an order you specify.

Standard Test

1. Install the NTSC loopback cable (standard monitor cable). Install the card in slot 3 for an Apple IIGS, or any slot for the Apple IIe.

2. Insert the *Apple II Video Overlay Card Diagnostic* disk and switch on the system. Pess the letter a or use the arrows to select **Execute Basic Functional Tests** and press <Return>.

   Press the Space bar when indicated.

3. On completion, the message **Testing Finished** will be displayed.

Customized Test

1. Insert the *Apple II Video Overlay Card Diagnostic* disk and switch on the system. Press the letter d or use the arrows to select **Choose Tests**, and press <Return>.

2. Highlight the tests you wish to run and press <Return> after each one.

   If you wish to deselect a test, use the letters or arrows to select the test, and press the <Delete> key.

3. On completion, return to the main menu, select **Execute Selected Tests,** and press <Return>.

   If an error is encountered, the testing will stop and a box will appear specifying which test failed.

4. On completion, the message **Testing Finished** will be displayed.

Continuous Test

A continuous (looping) test is available. Select the tests you wish to loop by following the instructions under "Customized Test" (see the previous page). Follow the steps below to run a continuous test.

Note: When you stop a continuous test, the looping function is automatically turned off. You must reselect this function from the menu if you wish to run the continuous test again.

1. After you have chosen the tests you want to run, return to the main menu, select **Options**, and press <Return>.

2. From the menu, select **Loop Tests Until Esc** and press <Return>.

   A check mark should appear beside the selection.

3. Select **Continue on Error Until Esc** if you want to continue looping, regardless of errors, until <Escape> is pressed.

   If you do not select this, the testing will halt when an error is encountered.

4. Return to the main menu, select **Execute Selected Tests,** and press <Return>.

   The tests will run (depending on your selection in step 3) continuously until an error occurs or until <Escape> is pressed. If <Escape> is pressed, looping is canceled.

   If you press <Escape> to stop the testing, you can then check for errors by selecting **Special** and pressing <Return>.

   Select the video display for a listing of the errors encountered.

5. If you are going to run the test again, be sure to clear the error log and the status line from the **Special** menu before returning to the main menu.

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Apple II Family Cards

Section 3 – Apple II 3.5 Disk Controller Card

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3.2 Product Description
3.2 Connecting More Than One Drive
3.2 What's in the Box
3.3 Troubleshooting
3.3 Troubleshooting Checklist
3.3 Symptom/Cure Troubleshooting

❑ BASICS

Product Description

The Apple II 3.5 Disk Controller Card allows you to use 3.5-inch floppy disk drives, including the high-capacity Apple SuperDrive™, with an Apple IIGS or Apple IIe computer. When installed in one of the slots inside the Apple IIe or Apple IIGS, this card supports the following floppy disk drives:

- Apple SuperDrive
- Apple 3.5 Drive
- Apple II UniDisk™ 3.5

Connecting More Than One Drive

You may connect up to two floppy disk drives to the Apple II 3.5 Disk Controller Card. However, when using more than one type of drive, be sure to follow the rules outlined below:

- If you are running GS/OS® on an Apple IIGS, connect the UniDisk 3.5 Drive to the Smart Port on the computer's rear panel. The Apple II 3.5 Disk Controller Card does not support the UniDisk 3.5 Drive on an Apple IIGS that is running GS/OS.

- Always place the UniDisk 3.5 Drive at the end of the daisy-chain.

- Do not use 1.4 MB high-density media with UniDisk 3.5 or Apple 3.5 drives. The UniDisk 3.5 and Apple 3.5 drives cannot reliably read or write information on 1.4 MB high-density media and cannot properly initialize the high-density media for use in the Apple SuperDrive.

What's in the Box

The following items are included in the Apple II 3.5 Disk Controller Card package:

- Apple II 3.5 Disk Controller Card
- A small wrench and two jack screws, used to connect the card's cable to the computer
- *Apple II 3.5 Disk Controller Card Owner's Guide*
- *Apple IIGS 3.5 Installer Disk*

For additional information on the Apple II 3.5 Disk Controller Card installation and setup, refer to the *Apple II 3.5 Disk Controller Card Owner's Guide.*

❑ TROUBLESHOOTING

Troubleshooting Checklist

To troubleshoot the Apple II 3.5 Disk Controller Card, perform the following checks:

***CAUTION:** Follow all electrostatic discharge (ESD) precautions when working on the Apple II 3.5 Disk Controller Card. Refer to the* You Oughta Know *tab in the Apple Service Technical Procedures for additional information.*

- Check the power source and power connections.
- Check all cables and cable connections.
- Verify the correct drive utility software is installed (Apple IIGS only).
- Verify the Control Panel setting for the correct slot assignment (Apple IIGS only).
- Reseat the card; it may be installed incorrectly.
- Observe the LED on the Apple II 3.5 Disk Controller Card. If the LED is on steadily or blinking continuously, replace the card.

For additional troubleshooting information, refer to the Symptom/Cure Troubleshooting section that follows. If you suspect a problem with the disk drive, refer to troubleshooting for the appropriate disk drive in *Apple Service Technical Procedures*. If you suspect a problem with the system, refer to troubleshooting in *Apple IIGS Technical Procedures* or *Apple IIe Technical Procedures*.

Symptom/Cure Troubleshooting

Find the symptom that most nearly describes the problem; then perform the first corrective action on the solution list. If that action does not fix the problem, go to the next action. If you replace a module and find that the problem remains, reinstall the original module before going on to the next action.

- **Known-good drive does not turn on when you switch on the computer**
  1. Verify that the Control Panel is set for the correct slot assignment (Apple IIGS only).
  2. Make sure the disk drive is properly connected to the computer.
  3. Refer to the troubleshooting section for the appropriate disk drive in *Apple Service Technical Procedures*.

- **Computer does not recognize all the disk drives connected to the disk drive port**

1. Verify that only two drives are connected to the computer. If more than two drives are connected, switch off the computer and remove the additional drives.

2. If a UniDisk 3.5 drive is connected to the computer, make sure it is placed at the end of the daisy chain.

3. If you are running GS/OS on an Apple IIGS, make sure that a UniDisk 3.5 drive is connected to the Smart Port on the computer's back panel.

- **Disk drive does not read or write**

1. Switch off the computer and reseat the Apple II 3.5 Disk Controller Card.

2. Observe the LED on the Apple II 3.5 Disk Controller Card. If the LED remains on or blinks continuously, replace the card.

3. Refer to the troubleshooting section for the appropriate disk drive in *Apple Service Technical Procedures.*

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Illustrated Parts List

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IPL.3 Super Serial Card (Figure 1)
IPL.3 Profile Interface Card (Figure 2)
IPL.5 Extended 80-Column AppleColor Card (Figure 3)
IPL.5 AppleColor Card Cable (Figure 4)
IPL.7 SCSI Interface Card (Figure 5)
IPL.7 High Speed SCSI Card (Figure 6)
IPL.9 Apple IIGS Video Overlay Card (Figure 7)
IPL.11 Apple II Language Card (Figure 8)
IPL.11 Apple II Workstation Card (Figure 9)
IPL.13 Apple II 3.5 Disk Controller Card (Figure 10)

Note: The figures and lists in this section include all cards and cables that can be purchased separately from Apple for the Apple II products, along with their part numbers. These are the only parts available from Apple. Refer to your *Apple Service Programs* manual for prices.

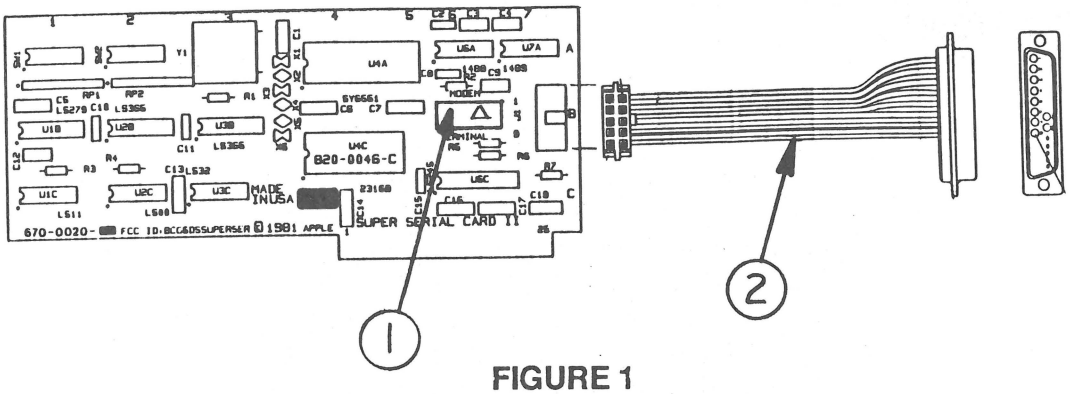

FIGURE 1

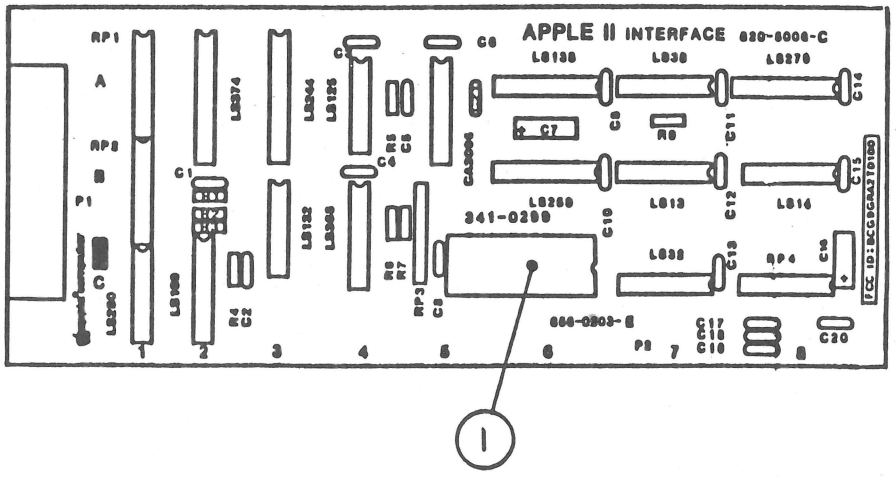

FIGURE 2

❑ SUPER SERIAL CARD (Figure 1)

Item	Part No.	Description
1	600-0008	Configuration Block SSC
2	590-0021	Cable Assembly Super Serial

❑ PROFILE INTERFACE CARD (Figure 2)

Item	Part No.	Description
1	341-0299	IC, EPROM XMEG Profile Interface

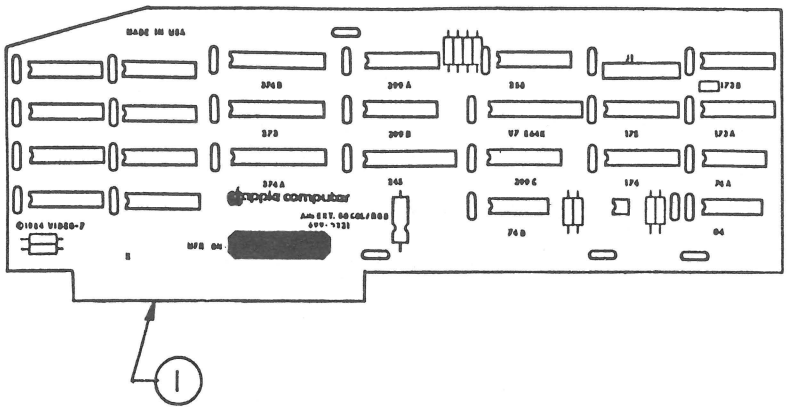

FIGURE 3

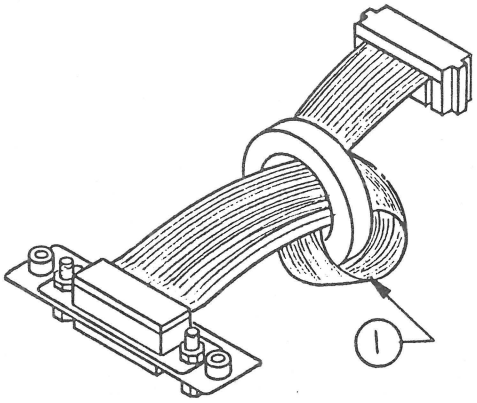

FIGURE 4

❑ EXTENDED 80-COLUMN APPLECOLOR CARD (Figure 3)

Item	Part No.	Description
1	661-0262	Apple IIe Ext. 80-Column AppleColor Card

❑ APPLECOLOR CARD CABLE (Figure 4)

Item	Part No.	Description
1	600-0180	Cable, Ext. 80-Column AppleColor Card

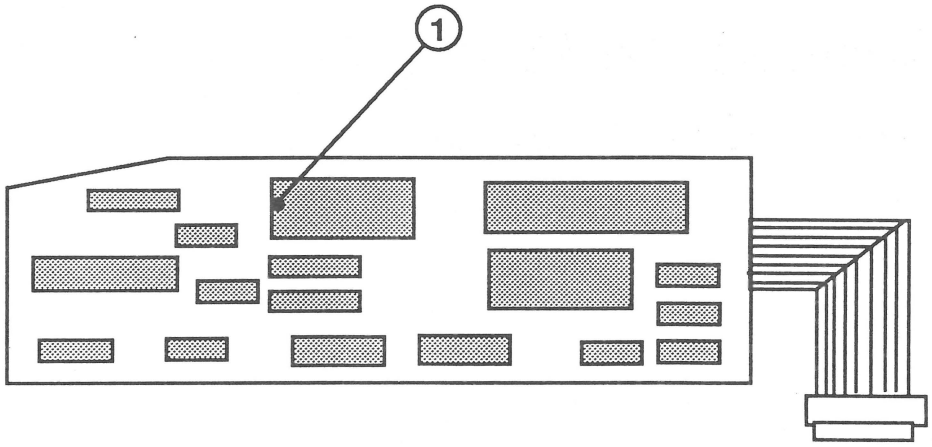

FIGURE 5

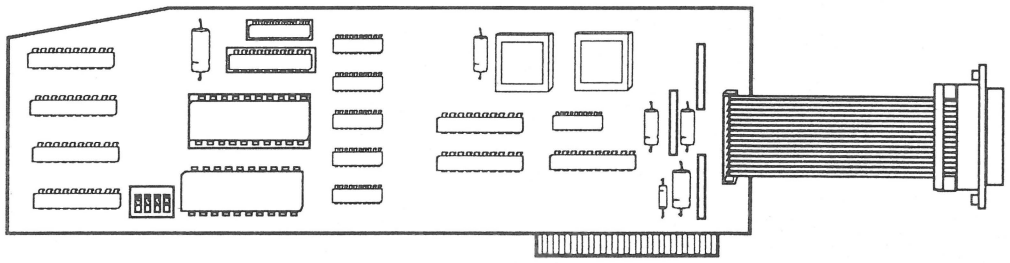

FIGURE 6

❑ SCSI INTERFACE CARD (Figure 5)

Item	Part No.	Description
–	341-0437	ROM, SCSI Interface Card

❑ HIGH-SPEED SCSI CARD (Figure 6)

Item	Part No.	Description
1	661-0499	Apple II High-Speed SCSI Card

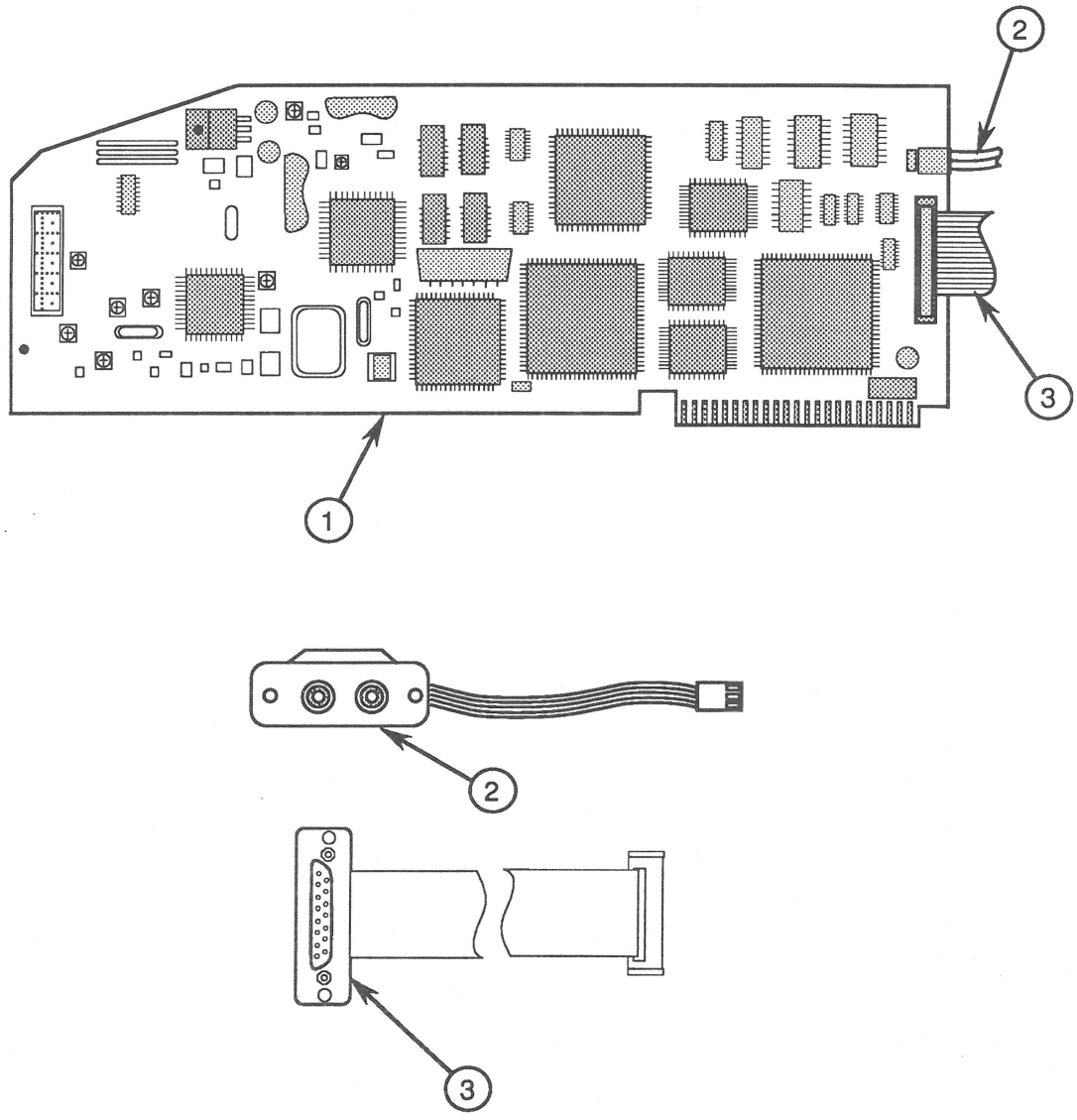

FIGURE 7

❑ APPLE IIGS VIDEO OVERLAY CARD (Figure 7)

Item	Part No.	Description
1	661-0385	Apple II Video Overlay Card
2	590-0620	Video I/O Cable, Apple II Video Overlay Card
3	590-0625	RGB Video Cable, Apple II Video Overlay Card

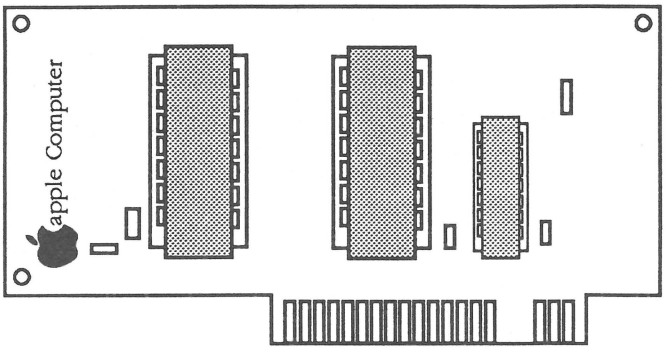

FIGURE 8

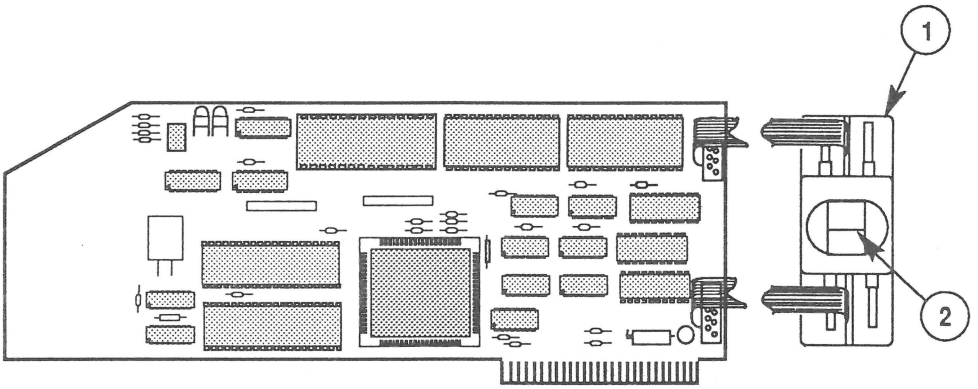

FIGURE 9

❑ APPLE II LANGUAGE CARD (Figure 8)

Item	Part No.	Description
–	661-91026	Apple II Language Card

❑ APPLE II WORKSTATION CARD (Figure 9)

Item	Part No.	Description
–	661-0389	Apple II Workstation Card
1	607-5010	Back Panel Adaptor Box
2	607-5033	Apple II Spacer Clip

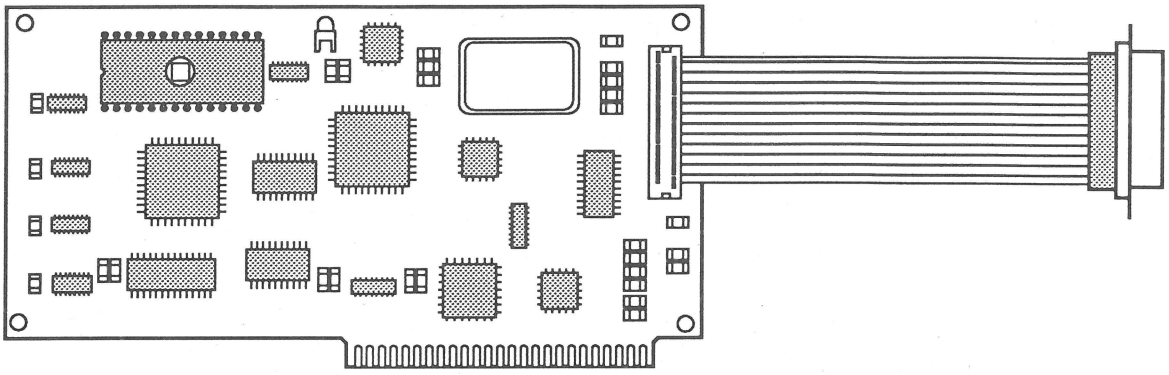

Figure 10

❑ APPLE II 3.5 DISK CONTROLLER CARD (Figure 10)

Item	Part No.	Description
–	661-1625	Apple II 3.5 Disk Controller Card